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The Farmer's Digest

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The Farmer's Digest

Volume 7 April, 1944 Number 11

A Critical Analysis of Artificial Breeding

Condensed from The Ayrshire Digest

C. T. Conklin

DURING the past five years it is doubtful if any other subject pertaining to dairy cattle has received as much publicity as has artificial breeding. "Test tube" cows have had their pictures in the newspapers. "Coast-to-coast" breeding service has made the headlines. Practically every agricultural magazine has given page after page to this subject.

With characteristic American enthusiasm artificial breeding has been seized as the answer to not a few of the genetic and economic problems of propagating better dairy cattle. And as one would expect, exaggerated claims have been made for this new procedure by well-meaning, but in some instances uninformed disciples, who sincerely believed that artificial insemination heralded a bright new day for dairy cattle breeders.

It is now only five years since this plan of cooperative breeding was really gotten under way in the United States and perhaps it is too early to correctly analyze its present status, or to attempt to evaluate its possibilities. However, recently published reports by the U. S. Bureau of Dairying and the American Dairy Science Association present an interesting picture of progress to date from which the following data are taken:

	No. of Assns.	No. of Members	No. of Cows
1939	6	646	7,539
1940	27	2,971	23,977
1941	37	5,997	70,751
1942	73	12,118	112,788
1943	99	23,448	182,524

Granting that substantial gains have been made during the past five years the point still remains that the volume of artificial breeding is still so small as to be relatively insignificant in its effect upon the breeding of the next generation of American dairy cows. In fact, less than three-fourths of one percent (.007) of

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Uncle Sam's dairy herd was bred artificially in 1943. Of course, this is only the beginning and no doubt there should be vast expansion, but until greater facilities are available, dairy cattle breeders still have the same old problems of sire selection which have always been theirs. Not until many times the current number of cows is enrolled will artificial breeding become a potent force.

Although one of the chief objectives of artificial breeding has been the broader and more effective use of outstanding or proven sires, the record shows that on January 1, 1943, only 135, or 23.5% of the bulls used in artificial breeding associations could be classified as proven sires according to the U. S. Bureau of Dairy Industry. Obviously proven sires are difficult to obtain and perhaps it is too much to expect that any greater percentage of proven bulls may be used artificially, especially when so called good breeders do not usually have as high a percentage heading their herds. However, if the supply of proven sires is limited to less than 25% of requirements, then the dairy cattle breeding industry should recognize that artificial breeding in itself is no cure-all and that before it can be expected to fully meet its opportunities, a vast pool of proven sires must be made available for it.

There can be no question but that leaders in this movement have wholeheartedly believed in the principle of using proven sires. In fact they are on record to this effect:

Knowledge and experience gained thus far emphasize the importance of certain conditions essential for success. Unless outstanding bulls are available whose inheritance, when widely disseminated, would materially improve the dairy cattle of an area, the organization should not be undertaken. Also, before an attempt is made to organize, the dairymen of an area should be genuinely interested in improving their dairy cattle.

Apparently it has been an easier matter to organize a group of breeders than to locate an adequate supply of proven sires. This is not strange, and in all probability such conditions will continue, for what dairyman wouldn't gladly be relieved of the responsibility of selecting herd sires? It is human nature to avoid repeating experiences in which we fail—and who hasn't failed in selecting herd sires? Artificial breeding associations are an "escape" from making decisions that are too often fraught with perplexities and disappointments. The average dairyman is willing to delegate this responsibility to someone whom he considers better qualified (which multiplies the responsibilities of the breeding association manage-

ment). In other words, it should always be a simple matter to sign up a good enrollment, provided costs are not out of line.

In fairness to those responsible, the 159 proven sires (23.5% of all AB sires) used have transmitted a particularly high average production, their average being 10,155 M. 419 F., whereas the daughters of all sires proven in 1942 in DHIA was 379 F., indicating that the proven sires selected have been quite successful. Of course, most of these sires gained their title and average before they went into association service.

Unfortunately the report of the committee does not include the number of bulls displaced through artificial breeding associations. Although it has been claimed that the numbers are large, the entire membership in 1943 was signed for but an average of 7.8 cows per member. On the other hand, there is an average of 318 cows per sire. Informal field reports indicate that not a few of those enrolled in artificial breeding associations are still retaining at least one herd sire and in many instances are breeding only their better cows officially.

No analysis would be complete without looking into the financial structure of these associations. That they should be able to pay their way and at the same time set up a satisfactory reserve for the purchase of new and better sires as well as other contingencies seems self evident. In addition, as these organizations increase, the comparative costs of private herd sire ownership and association membership will be more carefully considered by larger numbers of breeders. Obviously if owners are assured calves of higher merit through association membership, any reasonable extra expense will in most instances be relatively unimportant.

Reports to date indicate that artificial breeding associations have been operating on a cost of from $6 to $7 per cow. However, a question may well be raised as to whether any of the associations has carried its full share of overhead and managerial costs. In most instances, dairy extension specialists, agricultural colleges, county agents, and others have contributed a relatively high percentage of managerial hours at public expense. Without raising any question concerning the propriety of such investments for cattle improvement, the point should not be overlooked that if artificial breeding is to be general, then its whole financial structure may involve higher fees to those participating, or an out-and-out policy of supervision paid for by the public treasury.

Since the establishment of breeding associations the market for proven sires in at least certain

breeds has definitely advanced—even above the general rise in the cattle market. The point may well be raised as to whether the present rates of artificial breeding associations will permit these organizations filling their pens with sires fully up to the standards which they should own. It does not necessarily follow that an increase in breeding fees would be prohibitive. As a matter of fact there is a possibility that the entire dairy cattle industry needs a thorough "shake-up" with reference to breeding fees for dependable sires; and there is a probability that artificial breeding associations may be the means of raising these fees to the level they deserve. A glance at any publication devoted to race horses or dogs shows a striking spread between service fees for their outstanding males, as compared with sires on a comparable level in the various dairy breeds.

In the past, although there were many expressions to the effect that artificial breeding would "kill the bull market," there is every indication that to date it has had nothing but a stimulating effect on the trade in desirable bulls.

As might be expected technical knowledge concerning artificial insemination has made marked advancement during the past five years. Practically every phase of these operations has been studied with the result that the cows inseminated per sire have increased. Many of the problems pertaining to the holding and shipping of semen have been solved and a great deal of general information concerning the breeding of cattle has been obtained.

In conclusion there seems to be every justification to commend the artificial breeding movement in the United States for having made progress and for having attained perhaps as much success as any other phase of dairy cattle breeding during the past five years. On the other hand, it seems as though artificial breeding cannot become an important factor in a nation - wide dairy cattle breeding program until it has many, many times the present enrollment. It would also seem as though it cannot advance more rapidly than the herds of the purebred breeders who are responsible for furnishing the necessary sires.

Adjustment of Agriculture to Its Environment

Condensed from Better Crops With Plant Food

H. H. Bennett

Chief, Soil Conservation Service, Washington, D. C.

THROUGHOUT the world there is acute need for a much better adjustment of agriculture to its physical environment, not only to gain a sorely needed increase in agricultural production but also to maintain a healthy agricultural economy, which is currently being threatened in many parts of the world by continuing losses of basic soil resources. This adjustment is vital, moreover, if we are to maintain in efficient production the most widely distributed and greatest possible area of productive land as a safeguard against ever-increasing costs in distribution of agricultural commodities. And most important of all reasons: We must make the adjustment if we are to maintain our ability to produce in any adequate way.

Such adjustment can be made. We have the knowledge; we need only the decision. Practical experience to date on a far-reaching scale in the United States shows that the adjustment is possible, practicable, and almost invariably of great and immediate advantage to the farmer and the nation.

A needed adjustment that I desire to emphasize particularly at this time has to do with the elimination of wasteful land-use practices, haphazardly applied, and the widespread adoption, in their place, of various conservation practices scientifically fitted to the needs and physical characteristics of the land and the climatic environment. These conservation practices, applied in this way, at once safeguard the soil, increase its productivity, and conserve in the soil for productive use much rainfall normally lost as runoff.

This adjustment is of primary importance because it is the only way by which the agricultural plant of the United States, and of the world, can be kept in condition to support a permanent agriculture, and further, because it is the only way to get from the land anything like sustained, maximum yields.

To present the situation and the course of action with greater clarity, I will cite the problem in the United States, and what is being done about it.

Here in the United States we have used our fields with such

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prodigality that approximately fifty million acres of formerly cultivated land have been practically ruined by excessive erosion and cropping. This acreage has been abandoned for cropping, although some of it is in second-growth forest, some is used for wildlife, and some for limited grazing. Another area of about the same extent — fifty million acres more —is in a condition nearly as bad and is about ready for abandonment in so far as further cultivation is concerned. On a second 100 million acres of cropland, about a fourth to three-fourths of the topsoil has been removed by erosion, yet thousands of farm families have been using these impoverished lands in an almost hopeless effort to make a living.

Two hundred million acres of cropland ruined for further practical cultivation, or severely damaged, is too much land wastage for any country, especially when there is no real need for wastage of any land at any time.

But similar destructive effects of erosion are practically worldwide. Nearly every country has been affected. A few countries have come close to a solution of the problem on certain lands, but most countries have done little or nothing in the direction of either preventive or remedial action.

There are approximately four billion acres now arable on which the world must depend for food. These four billion acres must feed two billion people. That is two acres per person. Some countries have less than one acre per capita. Yet, some nutritionists say two and one-half acres per capita of reasonably productive land are necessary to produce even a minimum adequate diet.

Only about a fourth of the four billion acres of the world's presently arable land is really good land. Most of it has been damaged by erosion and exhaustive cropping. In some regions, the land has been made so poor by centuries of cultivation and unwise use that most farmers expect no more than the pitiful return of a bushel or two of wheat per acre, and two or three bushels of corn. We have some land of this kind in the United States, and in various parts of the Western Hemisphere this is the prevailing situation in a number of agricultural areas. Moreover, our best estimates at this time indicate that from two-thirds to three-fourths of the world's immediately available cropland is subject to impoverishment or outright ruin by erosion.

There are some scattered areas of unused good land about the earth, but probably not nearly enough to meet world needs, even if problems of agricultural utilization and transportation and distribution could be solved. And besides, these lands, too, are

largely subject to impoverishing erosion.

Clearly, this means that along with the good and the non-erodible land, a great deal of land that is subject to erosion, as well as much lean soil, will have to be farmed if basic food requirements are to be met. And since the agricultural lands of the earth, handled as they have been handled, have not adequately met the world's food requirements in the past, the one alternative is to increase in the future the productive capacity of a large share of the cultivable area that is available now. To do this, we shall have to adopt new and better ways of farming.

Such new and better ways of farming can be achieved through soil conservation farming and in no other way. Soil conservation farming everywhere calls for various major and minor adjustments and corrections in land use, but when it is put into effect, our experience on a widespread scale in the United States shows that two fundamentally important things are accomplished at the same time: Per-acre yields are increased and the soil is maintained in a continuing productive condition.

The work of the U. S. Soil Conservation Service was the first comprehensive, scientific, action effort in the world to achieve conservation of soil and water on a nation-wide scale. From the beginning, one cardinal principle dominated and guided this new program. Some called that principle idealistic and impractical; others failed to grasp its significance.

That basic, guiding principle was at the outset and is today as follows: Effective prevention and control of soil erosion and adequate conservation of rainfall, in a field, on a farm or ranch, over a watershed, or on any other unit or parcel of land, require the use and treatment of all the various kinds of land that occur within that area in accordance with the individual needs and adaptabilities or capabilities of each different parcel of land.

Like any precise statement of a rule, however, this principle requires some qualification.

First, the use and treatment of a given area of land must be determined not only by its physical characteristics, but also wherever possible by such considerations as available facilities, implements, power, labor, financial means, and even by the preference of the farmer, his ability to learn, and his willingness to try new methods. In other words, the treatment for conservation purposes must fit not only the needs and adaptabilities of the land itself but the needs and adaptabilities of the farmer as well.

The second qualification of the

general principle is that each distinct tract of land to be treated should be considered and treated, wherever feasible, in its physical relation to the adjacent land—field, farm, or watershed—if there is any important physical relationship. The use and treatment of one area should provide as much protection as may be practicable for adjacent areas. For example, the management of lands on the higher parts of a slope should be determined in relation to downslope and downstream lands. Gullies that pour rock, gravel, sand, and infertile subsoil material of any kind out over lower-lying land should be controlled so as to protect downslope land which cannot otherwise be protected.

Outlets for surface runoff should be located with proper regard to the effect of discharging water and solid materials on adjoining lands. And, of course, the areas devoted to crops, grazing, and forest should individually and together constitute a sound economic unit, or as nearly so as may be practicable.

To carry out such a completely co-ordinated soil and water conservation program on a nationwide basis requires a great deal of basic information for the most efficient blueprinting and planning of each farm and for the execution of the conservation job on the land. There are hundreds of different soils occupying varied slopes and subject to different intensities and amounts of rainfall and snowfall. No two parcels of land are identical. Accordingly, each field—even each important part of a field, pasture, or woodlot—may require its own particular set of conservation measures. Conservation specialists have found that in most localities each farm, each ranch, is a special problem within itself.

The soil conservationist has at his command many different types of control measures for handling different types of problems. Completely effective conservation practices, however, have not been developed for all the numerous problems and combinations of problems relating to all the contrasting agricultural lands and practices of the nation. It is necessary to seek constantly for cheaper, sounder, and more efficient ways of conserving our soil and water resources.

Soil conservation is the youngest of the agricultural sciences. And so from the very start, the practical field work has been supported by a program of soil and water conservation research through which new tools or methods of erosion control and better land utilization, as well as improvements on present tools and techniques, are being sought continuously. As fast as discoveries are made, they are carried to

farmers cultivating lands to which the new methods apply. They are not stored in the darkness of files or buried in ultra-technical papers and bulletins.

Where good covers of dense vegetation and good stands of forest have been established and maintained, as on steep erodible land retired from cultivation, there usually is no further need for protection against erosion. The losses of soil under such protection are negligible, often too small to measure, and the runoff of rainwater is also much less.

For example, the average annual loss of soil under continuous corn on the principal regional soil at the Zanesville, Ohio, erosion station has been at the rate of 94.6 tons per acre, and the corresponding loss of water as immediate runoff has averaged 42.4 per cent of the total precipitation. Under grass, however, the corresponding losses have been only .02 of a ton of soil per acre (1/4,730 as much as under corn) and 4.8 per cent of the rainfall (or about 1/9 as much as under corn). During a single period of heavy rains—nearly 11 inches falling during January, 1937, at the Zanesville station just before the record Ohio River flood—the measured losses of water as immediate runoff from a gullied corn field amounted to 94.7 per cent of all the rainfall, while only 31.5 per cent ran off from woodland, and 25.8 per cent from bluegrass.

Similarly, losses under good rotations, combined with terracing, or contouring, or strip cropping, or all of them, have been much less than under continuous corn and other wasteful ways of farming. These losses are from measured tracts of land, usually small tracts which nevertheless come pretty close to representing average conditions in this vast region of hill land characterized by shallow shale and sandstone soil.

Other measurements at the Zanesville station and at many other stations throughout the country show that conservation treatment continues to lessen runoff and soil loss regardless of how long or how heavily it rains and regardless of freezing and thawing. We have yet to find a piece of land that becomes so "saturated" with rainfall that it stops absorbing water. Continuing heavy rains do lessen, to varying degrees, the soil's capacity for infiltration of rainfall, but do not stop it. Unfortunately, this fact, only recently ascertained, has not yet got around nearly as widely as it should.

More and more is being learned about the control of erosion, the conservation of rainfall, and the better utilization of land in general—both through practical farm experience and research. A number of long strides forward have

been made in this direction recently and other important possibilities seem close at hand.

For example, the perennial lespedezas and kudzu have wrought profound changes in the use of much severely eroded land in many parts of the southern states. Lands which a little while ago were considered too poor or too steep or too erodible to farm—even some areas that were so gullied they could not be plowed at all—are now producing, with some fertilizer and care to get them started, excellent hay or grazing with these valuable crops. And these crops are holding the soil, retarding runoff, reducing the effects of silting, and generally raising farm income.

Turning soil upside down—according to the traditional way of plowing which has been one of the main functions of the moldboard plow—is not generally one of the wisest steps in agriculture. It puts the vegetative material, including grain stubble, corn stalks, grass, and legumes, as well as weeds or any other vegetative material, anywhere from 6 to 12 inches underground and turns fresh, loose earth to the top where it is exposed to the ravages of wind and rain.

When grass or other vegetative litter is lodged deeply underground, it cannot protect the surface. Fresh, loose soil exposed to the sun, wind, and rain on top of the ground is a rank invitation to trouble. The sun bakes the life out of the unprotected soil, at least temporarily. When it is dry, it falls loose and lifeless about the plow, so that wind can readily blow it away. And when any kind of rain heavier than a drizzle falls on it, soil washing results—sheet erosion and gullying—with an aftermath of muddy rivers and silt in reservoirs, harbors, and ditches. Where the slope is steep, there may be such a rush of water and soil downhill that crops go along with it. Also, the downhill wash of water and topsoil carries away both the added fertilizer and the natural plant food in the soil, along with the whole body of the soil. Still, there will be uses for the moldboard plow, as for plowing up water-diversion ridges, terraces, and drainage ridges ("lands"), and for use on certain soils of essentially level surface.

Throughout the country, technicians of the Soil Conservation Service and other agriculturists are striving to develop as rapidly as possible the new field methods and machinery precisely adaptable to the erosion control and production needs of each varying agricultural locality. Steadily, all this soil conservation work is taking the form of a new agriculture in our country—an agriculture based primarily on soil conservation farming methods. And to

date our progress with it is pacing the rest of the world.

Conservation farming puts first things first by attending to the needs of the soil—by seeing to it that the starting-off place, the base, is put into a condition of productive health and kept that way. Any other approach, no matter what it may be, always has and always must lead to eventual defeat through downfall of the base—the land.

Food is not produced just with written agreements, international or otherwise. Food in good output is produced only through the wise use of agricultural land. Yet from the standpoint of available resources, there is such a shortage of favorable agricultural land in the world that even before this war started, millions of people were always hungry and other millions lived under the almost constant threat of famine.

There is a widespread and a dangerous misconception about the world's productive soil resources. Many people think of the world as an amazingly vast place, abundantly stocked with rich land, much as frontiersmen of an earlier day in America believed there was a boundless reservoir of productive land beyond the western horizon.

Too many people have lost sight of the fact that productive soil is essential to the production of food. Apparently this fact has been so obvious and has been taken for granted so long the human race has just about arrived at the point of ignoring it. It should neither be taken for granted nor ignored, because there is no longer an abundance of productive land around the world. The somber truth is that the area of good soil on earth is becoming more and more limited. This means that the world's food production capacity is likewise becoming more and more limited.

With the area of arable land already subject to grave limitations in many parts of North America and with further losses of productive acreage in prospect, it becomes doubly important to recognize now the production advantages, and the protection advantages, of comprehensive, scientific soil conservation work when undertaken widely.

Conservation farming on many thousands of farms through the United States, producing all kinds of crops, has resulted in an average increase in per-acre yields of at least 20 per cent. In some instances the increase has been 40 per cent, 50 per cent, 100 per cent, and more. And this has been accomplished with very little additional labor, fuel, time, money, or machinery.

Twenty per cent increased production is the equivalent of adding a sixth farm for every five farms now in cultivation. Applied

to the nation, it would provide a vast additional amount of food, fiber, and vegetable oils.

Through its nation-wide cooperative conservation program of research, demonstration, and extensive work on the land, the Soil Conservation Service has spear-headed the technical program of development and application of new and improved measures for the control and prevention of erosion, for conservation of rainfall, for drainage, and for other measures of sound land use. The Service is helping individual farmers and groups of farmers to adopt these measures over the widest possible area.

The Soil Conservation Service is not a lending agency; it makes no benefit payments of any kind. Essentially, it is a corps of trained, experienced land specialists organized to work with the farmer out on the ground to provide security to the land and the farmer, to build soil productivity, to strengthen the individual, the community, the nation.

If there were some simple remedy for the ills of the land that could be applied as a standardized treatment indiscriminately, the job of soil conservation would be relatively easy. But there is as much variety in erosion as in the landscape of the country. Control methods that work wonders on Southeastern gully-torn cotton country may do more harm than good on the wheatlands of the Great Plains, and vice versa. Even on neighboring farms, land problems are seldom identical. And in those localities where much of the precipitation is in the form of snow, special measures are required for safeguarding farm and range land.

For these and other reasons, an effective program of soil and water conservation must be sufficiently flexible to meet the yarying physical conditions and economic circumstances.

The specific land treatments used and recommended by the Soil Conservation Service—of which there are 59 major types of treatment—may vary from one valley to the next, from farm to farm, and even from field to field. Before any work is done, each farm or ranch is carefully analyzed, the whole of it, both as a piece of land and as a business enterprise.

In making the physical analysis to determine productivity, needs, etc., field men of the Service carefully note the exact lay of the land, the quality of the soil, the degree of erosion damage, and the erosion hazards of every acre of every field, woodlot, pasture, and wasting gully. As accurately as possible, these conservation technicians determine which lands can be cultivated under good farm practices without excessive loss of soil and rainfall; which lands

need the protection afforded by special crop arrangements, special tillage practices, or structural installations; and which ones require a permanent cover of trees, grass, or other protective vegetation.

The next step is to work out with the farmer a farm blueprint for practicable operation, based on the ground information acquired. This the technician does, not indoors around a table, but out in the fields, pastures; woodlots, gullies, and abandoned and idle areas working alongside of the farmer himself.

In some instances, this new arrangement may not fit the farmer's pocketbook. It may call for more meadow crops than he actually can make use of and not enough soybeans or corn; it may involve other changes he cannot afford to make. If so, it is not a good arrangement in a practical sense, and it must be adjusted, if it can be, to meet family needs, market opportunities, etc. Purely from the conservation standpoint, however, farm arrangements based on physical land conditions and needs are ideal. The closer the operator can approach such a plan for his farm or ranch, and still make a good living, the more stable and productive his land will be, and the surer his income, over the long run and usually beginning the very first year the soil conservation work is done.

Drawing up a satisfactory land-use and land-protection farm blueprint is only part of the job. The other part involves the actual application of the plan to the land. Each parcel of land, even under the new use, generally needs some special practice or treatment for adequate soil protection, especially if it is sloping land subject to excessive washing or sandy soil subject to blowing. Excessively steep or unproductive croplands, for example, may be earmarked for a permanent cover of grass or trees; farm forests may be planned where grass is not paying out or is failing to hold the soil; gullied areas may be turned into grass-covered or legume-covered waterways, or farm sanctuaries for animals and birds, or valuable pastures of kudzu. Croplands generally should be farmed in rotation, usually on the level, and sometimes in strips. On the more erodible slopes, terraces are frequently needed for added protection. Pastures need to be limed, fertilized, cleared of weeds, and grazed with caution to improve the growth of grass. Woodlands need to be fenced to keep out livestock, they need to be protected from fire, and managed according to scientific principles of forestry. These are only a few of the 59 basic erosion-controlled practices that may be called into use across the Nation.

And, so, we have a new ar-

rangement of fields, pastures, meadows, and woods, with a new system of use and protection that safeguards the soil and fits the land as nature made it and as man uses it. Under such a plan, soil conservation is not just an incidental bit of the mechanics of farming; it becomes an essential part of the whole business of making a living from the land, and is the only way by which we may have permanently productive land for a permanent agriculture for continuing support of the nation.

Everyone is concerned in this; none can escape its implications. Productive soil is life and productive soil is vanishing with each passing year. The farmer, the banker, the legislator, and scientist; the teacher, the preacher, the welder, and clerk; all have a personal stake in the speed and thoroughness with which this nation, and every other nation, moves to the task. Generations yet unborn will curse or praise us, according to our actions with respect to this problem in the years immediately ahead.

A Six-Point Program

I propose for the next decade a six-point program of agricultural adjustment to physical environment to which I believe all informed men can readily subscribe:

1. An accelerated program of soil and water conservation, through soil conservation districts, as determined by the condition and use-capabilities of the land itself. Such a program should be geared to complete within a 10-year period the application of all major, needed conservation measures on all the erodible lands of the country normally devoted to clean-tilled crops, grains, soybeans, flax, cowpeas, and rice; that is, on approximately 242 million acres (not including about 76 million acres of farm land normally devoted to thick-growing, soil-protecting crops, exclusive of pasture, such as grass, clover, and lespedeza). As a necessary support of this program, a detailed physical inventory of the nation's land resources, showing their capabilities for use, should be completed at the earliest possible date.

2. Drainage of about 30 million acres of good land to improve the production of that part now in cultivation and to bring into cultivation that part which is now too wet for tillage of any kind. Much of this land is in drainage districts and most of it has been cleared for cultivation. (This drainage work would help speed up a needed shift away from cultivation on an equivalent or larger acreage of steep, erodible upland which should go out of cultivation and into a permanent protective cover of trees, grass, or legumes.)

3. Rehabilitation, development, and better utilization of water resources on approximately 12 million acres, largely in sub-humid regions.

4. A broadened educational program throughout the school and university system of the country and through all other appropriate avenues for the dissemination of information to acquaint children and adults alike with the importance, condition, and needs of their basic agricultural resources.

5. Rapid initiation of scientific investigation into the relationship between soil health—with particular emphasis on security against erosion — and human health and nutrition. This approach to human betterment has been neglected to an amazing degree by scientists almost everywhere.

6. Widespread development of needed water supplies and improvement of western range conditions through better grazing practices and livestock management. Under modern conservation practices for range lands, maximum production on a sustained basis is possible.

The vigorous prosecution of such a six-point program would increase food and fiber production in the United States by approximately 20 per cent.

Further, it would provide the nucleus for a sound, post-war rural works program. And in addition to its tremendous wartime and post-war benefits in terms of production and permanently protected soil, such a program would have a timeless value for human welfare far beyond our present ability to realize or estimate.

Salt Your Sheep

Sheep and lambs have a higher salt requirement per pound of body weight than any other farm animal. This is due to the larger amount of roughage they eat and to the salt lost in perspiration. They should have salt in covered boxes near watering places to take at will. Lambs will consume almost a half pound of salt a month; ewes a pound.

—*Sheep Breeder*

More Cattle in Alabama

Condensed from The Nation's Agriculture

Hartwell Hatton

SQUARELY across the State of Alabama, from the Chattahoochee River on the east to the Mississippi line where it elbows northward, nature has deposited a swath of rich dark grassland. It covers twelve counties with a combined area of six and a quarter million acres and is known as the Alabama Blackbelt.

Someone once said that if beef cattle had been indigenous to the southern United States and left free of human manipulation, the Alabama Blackbelt would have been its master breeding ground. But if nature missed a trick in the first place, there has been considerable human manipulation in late years and this area has become the scene of a rather remarkable development of the cattle breeding industry. It is strictly breeding country for the qualities in its soil which favor grasses and clovers and impart strong bones to grazing calves do not foster grains, especially corn. It is in feeding pens elsewhere that Alabama steers receive their carbohydrates, but that is beside the point.

The statistical division of the Alabama Department of Agriculture has just completed a survey of livestock in the State, extending from 1925 to 1943, both inclusive. According to its estimate the cattle population of the State increased from 840,000 in the earlier year to 1,140,000 at the present time. This includes cattle of all types, from Guernsey cows to scrub bulls. A separation of the figures in the report discloses a beef cattle increase from 475,000 head in 1925 to 702,000 in 1943.

This is for the whole State. Segregating the twelve counties covered by the Blackbelt and adding two counties which it touches, it is found that they harbor 48.48 per cent of the State's beef cattle while they account for only 20 per cent of the State's area.

Indeed cattle raising has become an important factor in the State's agricultural economy. Receipts at Montgomery's Union Stockyards approached $9,000,000.00 last year and there are smaller yards dotted about over the belt which add millions more to the total. But the Alabama livestock industry was born of adversity and nourished by it. When the boll weevil reached Alabama before the first world

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war, Blackbelt farmers found that their soil would not raise cotton fast enough to escape the new enemy. Cotton production dropped ruinously and the planter who had waged a lifelong fight with Johnson grass in his cotton middles made friends with the old foe. It became his salvation and pastures began to spread over land which for more than half a century had been dedicated to cotton.

The change, of course, did not occur over night. The farmer is a conservative in the strictest sense, and misfortune had to bang him around quite a lot before he transferred his fealty from cotton to cattle. It was in the years immediately following the war that the change-over began in earnest.

Montgomery County's experience is interesting because the county not only has the largest cattle population in the State but claims several other "firsts" and harbors the greatest livestock market in the Southeast.

There was, of course, some cattle raising in the Blackbelt before the war; enough, in fact, to encourage establishment of the Union Stockyards in Montgomery in 1918. It was in the same year that Lem A. Edmonson began his labors as Montgomery County agent. The 1920 census gave the county a cattle population of 25,875, based on 1919. Mr. Edmonson estimates that when the stockyards opened the figure was 2,000 smaller.

Meanwhile the Extension Service, working at Auburn, seat of the Alabama Polytechnic Institute, was striving valiantly to cope with the problem posed by the boll weevil. It was experimenting with pastures and doing its best to foster livestock production. Mr. Edmonson interpreted the Extension Services gospel in Montgomery County and several well-to-do landowners expelled cotton from their calculations and changed over to cattle.

A modest increase was shown in the county's cattle population in 1925 when a survey gave it 27,600. The next five years saw an increase to 30,404 and after that the number rocketed. The latest survey, for 1943, gives the county 63,000 head, of which, it is estimated, only 15,900 are dairy cows. The most rapid increase has occurred in the last three years: from 49,251 in 1940 to 53,250 in 1941 to 59,000 in 1942 to 63,000 in 1943.

This sprint in the industry is ascribed by Mr. Edmonson and, indeed, quite obviously is due to adverse labor conditions. Farmers who have shifted from cotton to cattle say that, dollar for dollar invested in operations, it takes ten times as many hands to raise cotton as cattle.

While the cattle industry re-

ceived its first impulse from the boll weevil and a new shot in the arm from the labor shortage born of the war, there was another factor in its growth which may not be overlooked. That factor was and is the Blackbelt Experiment Station which began operation in the late twenties right in the heart of the cattle country. Under the guidance of K. G. Baker, whose name has become legendary among Alabama's livestock producers, the station experimented exhaustively in pasture development and the results have been amazing.

Confining its investigations to the peculiarities of the Blackbelt, the station has catalogued and assessed the grasses and clovers which have proved natural to the area. It has also been able to induce landowners to improve their pastures with the addition of phosphate and lime and to enter enthusiastically into a terracing program. Thousands of tons of phosphate and lime have been added and hundreds of miles of terraces have been thrown up, and the work goes on.

All of this gives the Blackbelt a long grazing season. Black medic and hop clover appear early in March. White Dutch clover is two weeks behind and sweet clover has pasture value by April. These carry the cattle until the middle of June when dallis grass (paspalum to the professors) and Johnson grass appear. These grasses last until frost. All varieties of lespedeza do well and if allowed to put on full growth and seed will carry cattle to a very high condition in September and October. Alfalfa will flourish in some places and oats will make 40 to 50 bushels on $1-an-acre land. The same land will produce silage at $2 to $3 a ton. Improved pastures will put 50 pounds on a steer between June and October.

Two other fostering influences are exerted on the Alabama cattle industry to an extent important enough to command attention. In 1922 the first fat cattle show was held in Montgomery under the auspices of its chamber of commerce. Members of 4-H clubs were eligible to enter finished steers. It has been held every year since. The first prime beef produced in Alabama came through it. In the fall the Blackbelt Feeder Calf Association fosters a series of sales over the belt. To these come feeders from as far away as Indiana to haul off Alabama's fine steers. About 5,000 head were dispersed at these sales in 1943.

The Alabama cattle business was founded on a system of importing purebred bulls and turning them in with native cows. The system still obtains. Nolan Huddleston, of Montgomery, probably the outstanding figure in the

system, for a number of years has been importing from 500 to 1,000 purebred bulls annually from the West. Some people refer to him as the biggest bull merchant in the world. Certainly many white face bulls owe their acquaintance with Alabama cows to Mr. Huddleston. The reference to white face bulls is appropriate for 95 per cent of Alabama's beef cattle is Hereford. Black Angus and Shorthorn have their devotees but Alabama is a Hereford State.

Proteins from Phosphates

Condensed from Capper's Farmer

E. A. Cleavinger
Kansas State College

PROTEIN feeds are scarce. Concentrates are limited and legume hay supplies are inadequate to meet the needs of livestock and insure heavy maximum production. More protein will be needed in 1944.

Many farmers can produce much of this needed protein. Alfalfa is the most productive high-protein hay crop. In Kansas, for instance, there are now approximately 900,000 acres. This acreage can be counted on to produce about 1,800,000 tons of hay with an average analysis of about 14 per cent or approximately 252,000 tons of protein. However, more than half this acreage is too low in phosphorus to insure maximum production. Reports from other states, where land has been farmed longer and where rainfall is greater, indicate a similar problem, not only for alfalfa but for other legume hay crops.

Alfalfa is a heavy feeder on phosphorus. A ton of alfalfa contains about 10.3 pounds or units of phosphorus. A normal crop of 2 tons an acre thus removes from the soil about 21 units. Where the supply of phosphorus is low, the yield of alfalfa goes down. Tests on such soils have shown that about 25 units of phosphorus should be added an acre each year for the best production of alfalfa. This may be furnished by 150 pounds of 16 per cent, 125 pounds of 20 per cent, or 60 pounds of 43 per cent phosphate fertilizer. The amount needed will vary somewhat from section to section and from farm to farm. But there is no need to guess.

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Reasonably accurate tests are available.

From a demonstration on the P. B. Fundis farm in Coffey County, on a soil low in phosphorus, the following results were obtained: A field which had been limed was seeded to alfalfa the fall of 1939. A hundred pounds an acre of 43 per cent phosphate was applied at the time of seeding to all the field except about 2 acres. Next year the phosphated part of the field produced 5,042 pounds of hay an acre and the unphosphated part produced 4,050 pounds an acre. The following year phosphate was applied on the field crosswise to the previous application, again leaving 2 acres unphosphated. Thus part of the alfalfa was phosphated at seeding and again the second year, part was phosphated the first year only and part the second year only and a small plot received no phosphate either year. Yields of alfalfa on different portions of the field the first cutting of the second year were as follows:

Phosphated first and second year, 4,120 pounds an acre, phosphated first year only, 3,333 pounds; phosphated second year only, 1,910 pounds; check plot (no phosphate) 1,720 pounds an acre. In the last 2 cases, the hay was poor quality consisting mostly of weeds and grass.

In addition to improving yields of alfalfa, phosphating induces branching, greater leafiness and better color, all of which improve feeding value and market grade. Besides these factors, hay grown on treated land will contain more phosphorus for the mineral nutrition of animals. This will not be visible to the grader. It is measurable only by chemical analysis and by the vigor, health and condition of the livestock which consume the hay.

Where deficiencies exist, applications are best made at time of seeding alfalfa or other legumes. As indicated by results on the Fundis farm, this not only gives the greatest increase in yields, but insures good, vigorous stands. But, as also indicated by the same results, yields of alfalfa can be maintained and the life of the stand prolonged by annual or biennial top dressing. For best results, treating old stands should be done when the plants are dormant, or after the alfalfa ceases growth in the fall. However, good results have been obtained by an application immediately after the last cutting. Yield increases are never as great by top dressing after the first cutting in the spring. So a practical time to top dress old stands is in late winter or early spring before growth starts.

Application can be made with any suitable broadcast spreader or a fertilizer grain drill. The drill

is most satisfactory since it makes possible a more even distribution; prevents waste from blowing and washing; distributes the phosphate into the soil, rather than on the soil; puts the plant food down closer to the feeder roots.

As previously indicated a practical application of phosphorus for alfalfa on deficient soils would be about 25 units an acre yearly. Fifty units every other year would be the same rate. The question arises whether biennial application is advisable. Again referring to the Fundis demonstrations we find the yield was somewhat more where the fertilizer was applied annually in the lesser amount. But it requires going over the field twice instead of once and whether this is justified must be determined by the farmer, after he has taken into account the time and labor involved.

The most economical increase in yield of alfalfa from the use of phosphorus will be obtained on soils which are either naturally high in lime, or which have had an application of crushed limestone. It is true on a few soils that phosphorus is the most needed mineral for alfalfa production, but usually soils low in phosphorus are also low in lime.

Pasture the Year Round

As a result of his pasture experiments, Hugh McRae, New Hanover county, N. C., has several crops he wants the South to know about. They are Kobe lespedeza, manganese bur clover, crimson clover, giant white Dutch clover and Johnson grass. Here's how they cover the calendar:

Kobe lespedeza—September 1 to November 10.

Giant White Dutch clover—September 20 to November 20.

Manganese bur clover — November 18 to April 20.

Crimson clover—December 1 to May 15.

White Dutch (re-seeds)—February 20 to July 15.

Johnson grass — May 15 to November 15.

Lespedeza (re-seeds)—July 1 to November 10.

Before one crop runs out, another is coming along, and they all grow fine together in the same fields. His pasture takes care of cattle the year around, without winter feed.

—*Farm Journal*

Wool Quality Depends on Soil Fertility

Condensed from Midwest Wool Growers News

Dr. William A. Albrecht

Chairman, Dept. of Soils, University of Missouri

THE geographic location of sheep puts them dominantly on drier soils. Natural survival of them seems to be high in regions of lower rainfall, where soils are less leached of their fertility. Hence, it is on the soils richer in lime, and on grasses grown where calcium and other soil-given nutrients are active in both the soil and the plants, that we find the best reproduction and growth of these producers of both wool and meat. That their wool manufacturing business, like their meat making activities reflect the differences in soil fertility is not so commonly appreciated, even if we have the different breeds for the fine and the coarse wools in different climates and therefore on different soils. But when the same soil in adjoining plots given different fertilizer treatments makes different wools on the back of animals of the same breed, in the scouring vats and in the final carded fibers, we must come to consider the fertility of our soils as a factor in controlling the quality of the wool. Better wool from better soil may be a new slogan to bring the wool producer of the humid region, at least, to consider economic and efficient wool production in terms of soil fertility. This is the suggestion that comes from some experiments testing sheep responses to soil treatments.

In an attempt to use a smaller ruminant than the cow to measure the possible improvement in feeding value of lespedeza hays in consequence of the treatments of superphosphate and lime on the soils growing them, sheep were chosen as the test animal. The lespedeza hay was the legume companion crop of wheat in some of the soil studies of the experiment station. Three plots were involved, of which one was given no treatment, one had superphosphate on the wheat at fall seeding, and one the same amount of phosphate but as an addition to limestone on the soil. The wheat was harvested in June and the lespedeza in the stubble made into hay in August to be used as the sheep feed in the dry lots.

Since the plot with no soil

Reprinted from Midwest Wool Growers News, Jan., 1944

treatment produced too little lespedeza hay to carry a significant number of sheep for a good number of days, it could not be used in the first trials. Feeding tests were consequently made with only two lots of lambs. One of these lots was fed on lespedeza hay grown on soil given phosphate, and the other on hay grown where both phosphate and lime were the soil treatments. The grain supplements of corn and bran and all other features of management were the same for the two lots of sheep kept in adjoining pens.

Since the aim was not that of fattening the sheep, but merely one of carrying some weanling lambs through the winter on a moderate amount of feed, only a small daily allotment of grain was given while the hays were fed liberally. The hays were not completely consumed. The unconsumed portion was weighed and careful record kept of the amount taken under a liberal selection by the lambs that left coarser stems and other plant parts. The lambs were put under the experiment in mid-September and carried through until March.

Differences in appearances of the two flocks were detectable before any pronounced differences were shown by the weekly weighing. Those fed on the hay grown where phosphate only was the soil treatment appeared to have cleaner wool, their tops were smoother and there was the general finer wool appearance. Those lambs taking the lespedeza hay grown where both limestone and superphosphate had been the soil treatment appeared as if the wool were not so clean. Their tops were more rough to suggest the effects of more severe weather. These differences persisted and became more pronounced as time passed.

When the animals were given closer study by opening their fleeces, the much more abundant yolk was evident on the rough-appearing lambs feeding on the hay grown on the land given lime and phosphate. The differences in body weights, too, were emphasizing the greater efficiency in animal growth per unit of this hay consumed. When the yearlings were shorn in the spring, samples of wool were collected from the corresponding several parts of the body as the fleeces were weighed and found to be slightly heavier in case of those from the sheep on the hay given both lime and phosphate as the soil treatments.

More significant, however, than any difference in yolk contents of wool, or weights of the fleeces, was the behavior of the wool samples during scouring in dilute alkali solutions. Those from the fleeces with little yolk, or from animals consuming hay grown on soil given phosphate only, seemed

to collapse, and appeared as if the fiber were almost a colloidal or jelly-like form. Those samples with much yolk, or from those sheep fed on the hay grown on limestone and superphosphate as the soil treatments, stood up in the scouring liquid to retain their fibrous appearance. When the wool samples were finally rinsed out, carefully air-dried, and carding attempted, those originally with much yolk carded into the usual fluffy, resilient condition of carded wool. Those originally with little yolk coming from the animals given hays with phosphate only could not be carded without breakdown of the fibers.

Difference in wool quality in these cases was not due to a difference in breed, nor to difference in animal age, and not to a difference in planty variety in the feed. It was due to a difference in the soil fertility occasioned by so little as the few hundred pounds of superphosphate combined with the few thousand pounds of limestone put on the millions of pounds of soil per acre. These changes in the physiology of the life of the soil came through as changes in the physiology of the same kind of plants as hay, as sheep eating it, and as decided differences in the quality of the product for which sheep are particularly grown, namely, the wool.

We have not concerned ourselves too seriously about the soil fertility needed to grow animals, when we are thinking of simply going to extensive pasture farming as a soil conservation measure intended to master the problem of soil erosion. Erosion is most serious in regions of high rainfall. It is disastrous in soils that have been cleared of their original timber crops. It is devastating on these soils that are naturally already highly leached of their lime and other fertility elements, and that have their much more leached and much less fertile sub-soils coming up through erosion to be the surface soils.

We need to remind ourselves that sheep, like cattle are most prolific and productive with minimum of attention in the regions of lower rainfalls and where the soils are still amply stocked with lime and corresponding mineral plant and animal nutrients. It is in what may well be called the "Midlands of the U. S." that prize animals are produced. It is on the regions of rainfall so low as to make short grass that sheep are well nourished on pastures. It was on these same areas that "Buffalo grass" abounded, or that more scanty vegetation on which the buffalo located his herds and survived. If extra tonnage of feed per acre or minimum of roam to gather it had been his objective surely he would have left the short grass

country and gone eastward into the blue-stem regions.

Natural animal distributions are pointing to the differences in the fertility of the soil as the basis for the differences in nutritional services of the forages to the animals. Soil treatments in the more humid regions are helping us to understand that it is animal nutrition that determined the distribution. They are demonstrating that animal reproduction, animal growth, and animal output of their products such as the wool of the sheep depend on the fertility of the soil reflected in the feed. The animals are, and perform as, they are fed. Feeding is not so much a matter of large amounts consumed, but a matter of the quality of the feed taken which as hays and forages goes back to the fertility of the soil where they grew. Wool is an animal crop and in the last analysis, it comes from the soil, too. Its quality, therefore, depends on the soil fertility.

Good Management Pays

Condensed from Turkey World

Dr. J. N. Thompson
Texas Agricultural Experiment Station

AN average production of 86 eggs per hen with 91 percent fertility and 81 percent hatchability of all eggs set was obtained at the Texas Agricultural Experiment Station last year with 56 balanced, heavily fleshed, Broad Breasted Bronze turkey hens. Ninety-six percent of these eggs were laid between January 1 and June 1, and 84 percent between February 1 and June 1. The others were laid prior to January 1. Similar results were obtained in the 1942 season with cross-bred hens mated to Broad Breasted Bronze toms. The latter birds were from stock having no special breeding behind them.

Breeders, which were range reared, were selected during November, placed in 14 by 14 ft. turkey mating houses, and were kept confined completely in these houses until the end of the hatching season. A tom was placed with the hens early in the season so that the hens and tom would have more time to become adjusted to each other and increase the chance of getting good fertility. It was felt that toms should be put with hens in pen matings earlier than in flock matings where more than one tom is used. Well matured toms that were hatched prior to April 15 and pullets hatched in April were used. The April-hatched pullets had developed well enough to

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give good results but did not come into production too early for best use of the eggs.

No effort was made to keep the hens from getting fat before laying when the fat was put on from a balanced type of feed such as was used. They would have been considered too fat by many, but extra weight was considered as a reserve to carry them through the season in good condition. They were still in excellent market condition when disposed of in June after laying an average of 86 eggs.

The feeding of the laying ration was started December 15, approximately six weeks prior to the time production was desired. Whenever a given pen came into production prior to this time, they were changed immediately to the laying ration. This was done so as to prevent the early producing hens from depleting their bodies and getting out of condition as a result of an inadequate diet. When this was practical, most of the early producing individuals gave a good record through the whole season.

A feed trough, 4½ ft. in length, was kept in the center of the floor. It was kept in this location for a special reason. The feeder, being away from the wall, provided feeding space on each side and bossy hens found it difficult to boss both sides of the trough at the same time. The highest producing hens required the most feed, and it was usually the poor producing hens that tried to boss the feeder. This arrangement was important in the pen matings since the birds were confined to close quarters.

A feed mixture was used which contained both mash and grain. It was not truly an all mash ration, since whole wheat, whole oats, and cracked yellow corn (particle size about equal to wheat), were included in this mixture. This feed was kept before the birds in the feeder all of the time. A small amount of this feed was fed fresh each day to stimulate feed consumption. Consumption was further stimulated by making a practice of hand-stirring the feed in the feed trough once or twice a day while trapping the birds or when gathering the eggs. A small amount of additional grains was fed on the top of the mixed feed in the trough the latter part of the hatching season.

It is true that the birds picked out some of the whole grains, but the protein consumption was at a more uniform level than when mash and grain are fed separately. Feed containing whole grains was coarser and the birds could fill up more quickly in the morning and before going to roost at night when an all-mash ration was used. Cracked oyster shell was kept before the birds all the time in a separate hopper, and some tur-

key size granite grit was fed once every two or three weeks. Large size grit was used because the birds' gizzard retains large grit better than small grit. It was not kept before them all the time, since large grit as well as small grit passes through the digestive tract rapidly when fed in excessive amounts. The ration contained enough calcium for the average hen laying at an average rate, but a definite improvement in shell strength, structure and color was observed when cracked oyster shell was fed in addition to that in the feed mixture.

The ration was one which had been used at the station and adapted to confinement conditions. It has approximately 16.5 percent protein, 2.3 percent calcium, and 1 percent phosphorus. The main difference between this ration and those used for range conditions is that it contains more oats as a source of bulk, more alfalfa for vitamins A and G, and more vitamin A and D concentrate. An adequate supply of each of these factors is essential in obtaining good results. Animal protein and vitamins A, D and G were supplied from more than one ingredient in the mixture. This was considered important with birds in confinement since they are entirely dependent on the mixed feed given them. For example, if poor quality alfalfa leaf meal was used in a batch of feed, there would be other ingredients containing vitamin A to help prevent a deficiency.

The mating houses used in this system of management were spaced 50 ft. apart so that hens in one house would not become interested in toms in adjacent matings. Separation of the matings is very important where the same tom is kept with a mating of hens the entire season. High fertility has not yet been obtained at the station in pen matings in larger houses with only partitions separating the matings, even when the view from one pen to another was obstructed. Distraction takes place through sound as well as sight when matings of turkeys are very close to each other. While separate housing of pen matings requires slightly more labor and investment, it does provide better ventilation, a dryer house, more light, less distraction between matings and better control over diseases than larger houses.

There was no sun porch provided for the breeder house since the arrangement of the house was such as to provide a more uniform environment from day to day than could be had with the use of a sun porch in good weather and confinement to the house during bad weather. Turkeys do not stay in the house of their own accord during bad weather, and it would be harmful to confine

them since they are extremely restless for the first few days after confinement.

The house has a direct and indirect ventilating system. A louver in each end of the gable roof and two air vents directly under the roof on each side of the house forms the indirect ventilating system which takes care of the ventilation when the large ventilators are closed. The indirect ventilating system was of most importance during the severe Texas "northers," when it was necessary to close most of the large ventilators. Drafts from the vents were prevented by the two feet of boarding which was nailed on the under side of the rafters. The large shutters, when open, formed the direct ventilating system. The upper row of large ventilators were high enough to prevent too much draft during ordinary weather conditions in this region. During the cooler weather, the large ventilators were kept closed on the windward sides. During hot weather, the upper and lower ventilators were kept open.

To simplify the work, a system for regulating the ventilation was used so that changes in the position of the ventilators were required only between seasons and during severe changes in weather in the same season. Through the indirect ventilating system and the direct ventilating system, consisting of upper and lower large ventilators, it was possible to keep the house adjusted for extremely cold or extremely hot weather or any weather condition in between. A longer prop can be used to raise the large ventilators high enough to admit direct sunlight in the house when it is impossible to obtain satisfactory vitamin D concentrates because of wartime shortages.

In the house eight trapnests were provided for each mating of 14 hens. This was not found to be too many, since the hens spent a longer time on the nests before laying as the season progressed. The nests were placed under the dropping boards to conserve space, and with proper spacing of the trap front on the nest, they were not inconvenient to use. The back of the nest was covered with 2 in. hexagonal poultry netting and a space of approximately 6 in. was left between the rear of the nest and the wall. The hens went into this type of nest readily and very few floor or unidentified eggs were had. This is the only nest arrangement that has been tried here and found satisfactory to prevent floor eggs. In pen matings, where the hens are not trapnested, burlap was hung loosely over the nest openings to darken them. It helped prevent several hens from using the same nest at the same time and breaking eggs. The perches were placed against the solid wall, which faced north.

It was arranged this way so that the birds would be protected if there was a severe change in weather during the night and the large ventilators were left open. Perches 2 by 2⅛ in. in size, with the top edges rounded, were used.

An egg shelf and an egg record board was placed in each house as a part of the regular equipment. When housing the breeders, the dirty egg problem was eliminated. A coop for broody hens was built in each house as a part of the regular equipment. The broody coop was placed in a convenient location in the house, which made it possible to give credit to the proper pen for any eggs that might be laid while the hens were in the coop, and in many cases give credit to the specific hen that laid the egg. It was placed off the floor to conserve floor space and to provide plenty of ventilation which is essential in breaking broodiness in hens. A wire floor was used in the coop so as to further prevent hens from setting. When hens showing the signs of broodiness stayed on the nest without laying for three or four days, they were put in the broody coop. With plenty of the laying ration and drinking water kept before them, they usually came back in production within two weeks.

Many hens continued to lay for a long period while showing all indications of being broody. For example, hen No. 132 showed signs of being broody more than half of last season. She stayed on the nest all day and all night but was in heavy production the whole season. She laid a total of 119 eggs. Her eggs were fertile and hatched well. The hens showing signs of broodiness were taken off the nest several times during the day when trapping, since it was observed that they would go by the feed trough, eat a little feed and get a drink of water each time that they were taken off the nest. When the birds were not allowed to go "off feed," it apparently kept some of them in production.

Artificial lighting of the turkeys was started January 15 and the hens came in full production about February 1. The length of the lighting period was reached in one week after starting the lights. The males were not lighted earlier than the females but as already stated, well matured toms were used. The birds were lighted in the morning long enough to give them a 14-hour day. The 14-hour schedule was continued for the full hatching season. Twenty-five watt light bulbs were used. The lighting equipment was suspended in a position where the light could shine on both the perches and the feed trough.

Eggs were set approximately once every seven days, and in no case were they held longer than

10 days. All the hatching eggs were turned twice each day. The hatching eggs were kept in a room where the temperature was rather uniform, usually within the range of 50 to 60 degrees F. The humidity in the room was kept rather high. The egg tray stand was constructed in such a manner as to give plenty of ventilation and allow the eggs to cool quickly. A very close control over temperature and humidity was very important when eggs were kept longer than seven days. However, it has been observed that chicken eggs deteriorate rapidly in quality under some environmental conditions that do not seriously affect turkey eggs. The large size of turkey eggs, the thicker shell and shell membrane was probably the reason for the difference.

An incubator with a forced ventilating system was used. The eggs were incubated at approximately 99.5 degrees F., with a wet bulb reading of 85 to 87.5 degrees F. A temperature of approximately 100.5 degrees F., with a wet bulb reading of 90 to 92 degrees F., was maintained in the hatching compartment. The early part of the season, the dry bulb readings were kept about one-half of a degree higher than the above figures and the latter part of the season they were kept about one-half a degree lower. This was done in order to keep the poults hatching on the proper date and hatching free of unhealed navels. The wet bulb readings were kept about the same through the whole season. There was some difficulty in keeping the humidity high enough in the hatching compartment and wet cloths were used on top of the pedigree baskets for most of the hatches. The cloths were dampened early in the morning, afternoon, and at the last egg turning at night. The incubation temperature and humidity levels were pretty well in line with the recommendations given in the recent Kentucky Station Bulletin No. 438, which is devoted exclusively to the incubation and hatching requirements of turkey eggs. Pedigree poult hatching baskets 3½ to 4 in. high which were designed at the Texas Station were used. The common size chick pedigree baskets were not found very satisfactory. They were so small that many of the poults were kept in cramped positions too long and developed leg and neck deformities.

The future for turkey breeding improvement work seems very promising. While it is recognized that breeding work requires knowledge, experience and patience, as well as more investment in equipment, labor and advertising, a sale of 80 eggs per hen at a price as low as 30 cents per egg would gross $24 for each hen. A gross profit considerably higher than this eventually could be

made since pen mating eggs from outstanding and reputable breeders at the present are selling at one dollar and up per egg. While breeders have to charge more for eggs of special breeding because of higher cost in producing better quality, the future outlook for those interested in breeding improvement work should be a very encouraging one. The turkey industry is expanding so fast that there is a shortage of special quality breeding stock, and the breeders with quality birds cannot supply the demand. A wide use of a program of this type probably will not flood the market with hatching eggs, since the nature of the program itself limits volume production, but it does make opportunities for breeding work more encouraging. In fact, many producers could afford to decrease their volume and produce better quality birds.

Pruning Apple Trees

Condensed from American Agriculturist

M. B. Cummings

Vermont Agricultural Experiment Station

THE era of severe pruning is nearly passed. The period of moderate pruning has been ushered in. Our ideas change with the times, and swing like a pendulum from one extreme to the other; but as a cessation of the pendulum brings a compromise, so in pruning, moderation is the watchword today.

Once we used to cut the small tree severely, and kept at it till there was little left to grow or to build upon. Now, in a more sensible manner, we prune but moderately, and not too often at that. When the small tree is set, we shape it up for strength and good form and strong unions of laterals and uprights, and then leave it much alone for several years. Let it grow up with the least setback and hindrance. Do not keep cutting back the small tree; give it a chance to grow. Size and height are needed early in life.

Heavy pruning is undesirable. It hampers the tree, checks and dwarfs it. Therefore, prune it well once, not necessarily severely, then leave it to grow for several years.

Each cut on a tree should have a meaning behind it. Do not use the knife or shears or saw without a purpose. Have the reason

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in mind first; see or try to see what the effect of the cut is before it is made. One cannot replace a cut-off branch. Justify the cut before the operation is effected. This is equivalent to using the head before using the hand. Thinking before acting is time well spent. Make the operation an educational process.

After a few years following the first pruning, we turn again to the half-grown orchard tree and resume pruning with an eye to the most urgent cuts. What are they? First of all come weak crotches of forked branches. Cut out one of a Y-formed condition. Correct the fork before it gets bad or breaks. Secondly, cut out criss-cross branches so as to avert all rubbing or friction. Watch the direction of growth; guide it outward and upward, not inward or downward. Keep the tree fairly open, let the light and air in evenly all around; but do not make large holes or open places in the tree. Keep the head uniformly open, and still uniformly close, all over. This requires foresight and planning from the beginning. It can be done, and it pays to do it this way.

Each variety of tree has its way of growing and responding to pruning work. Many sorts tend to fork and grow close and erect in early life, and spread more and more with age. Spy and Delicious are of this type. Greening, Tolman and Baldwin grow more open and spreading from the beginning. McIntosh and Macoun are intermediate to the two groups just cited. It is well to note the habit of growth, and follow it. One cannot make a Greening grow like a Spy, or a Spy like a Greening.

With a bearing tree the first thing to learn is to be able to recognize the bearing wood, called spurs, which are the short stocky zigzag twigs that grow as side branches. These bear the fruit buds and should be saved. Sprouts on the other hand are long, slender, vigorous shoots that bear late in life, if at all. Cut these out, unless they are needed to replace a dead, diseased, or broken limb. The rule, then, should be to save the spurs and cut the sprouts.

Every wound should have a good chance to heal. It should be clean, short, smooth. Do not leave any stubs or splits or "teardown" places. Use sharp tools, make hard, smooth wounds that can soon heal over. A pruner who cannot cut properly and leave only good wounds had better turn to some other work. A good pruner is a credit to himself and others; a poor pruner is a menace to the health of the orchard; give him another job! The aim should be to do all the good one can, and as little harm as possible. It can be done.

Automatic Chicken Culler

Condensed from New Jersey Farm and Garden

William A. Haffert

CAN chickens be culled automatically and mechanically? And with almost unfailing accuracy?

Ask that question of any poultryman and the answer, of course, would be an emphatic "no."

Books have been written about culling, courses have been given in how to tell the laying hen. And even then many, especially the less experienced poultrymen or those having heavies, are in doubt when it comes to picking and separating the layers from the liars.

There's a young man in Somerville, N. J., who has given this much thought. He is M. E. Bowers, district representative of a feed company, farm born and raised, and with much experience in a service capacity on poultry farms. And ask him that question about the possibility of mechanical culling and his answer will be a positive "yes," for he has perfected a jimcrack, amazingly simple, that does the job.

The thing is actually so simple it is almost unbelievable. Yet in tests on many New Jersey farms, conducted since last September, it has worked and is working. All it consists of is a bar placed across the nest opening at such a height that a hen entering the nest must brush the bar with her back. On this bar is a piece of felt, acting like a wick, and saturated with a stain. As the hen brushes the wick her back is stained.

The gadget is used for five days each month, then removed. At the end of five days any bird that has not visited the nest has a nice clean back, the others have stained backs. All that remains is to remove those with a clean back and the culling job is done!

"Of course the thing is not foolproof," says Bowers. "There will always be a few who lay on the floor, and some others who are non-laying busybodies and visit the nest without leaving an egg. But the percentage is so small that the total figures on any given plant will not be materially affected by them. Biggest job I had was to perfect a stain that would be clearly visible after the five-day test, and yet fade away completely before the next month's test is made. I've got this now and tests have been run on a number of plants with complete success."

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Bowers uses a green stain for White Leghorns and a black stain on Reds and Barred Rocks. Hardest to tell are the Rocks, but the stain, he says, is visible in that it blackens the white bars on the Rocks and makes an easily seen mark.

On the farm of Albert Koch, Freehold, a test was run recently on a pen of Leghorns. At the end of the first two days, ninety out of the 110 birds in the pen were marked. On the Rupell farm, with 135 birds in a pen, the average was 125 with markings at the end of the five-day test.

Bowers has his device patented but he does not intend to market it generally until next year. This year he plans to distribute it (cost about $1 per pen for the average farm) through a limited list of dealers not too far from his own neighborhood, so he can keep an eye on results and see that the gadget is properly installed and operated.

The culling plan that Bowers advocates is to put the "automatic culler" in a pen five days each month, take out the unmarked birds on the sixth day, and continue this at least from March through September. He figures that it costs about a cent a day nowadays to feed a bird, and every non-layer that is gotten out of a flock saves that much every day, makes room for layers and contributes to the feed conservation program.

The seasoned, experienced and good operator probably would have no need for an aid in culling. He does it regularly, and does it well. But there are many who never cull, either because they don't know how, or because they don't believe it worth the effort. Bowers feels that it is the latter group for whom his device will prove a god-send.

Anyhow, it remained for a Jerseyman to reduce culling to a matter of mechanics with the hen itself the operator.

How Much is a Ton of Hay Worth?

An answer to that question is offered by George Taylor, extension dairyman. Says Cowman Taylor, a ton of good hay is worth about two-thirds price of a ton of grain. If grain is selling for $50 a ton, dairymen can afford to pay $33 to $34 a ton for good hay.

Hay, continues Mr. Taylor, has a greater effect upon production than grain mixture, a fact that many dairymen fail to realize.

—A. K., *American Agriculturist*

Whey—A Valuable By-Product

Condensed from The Jersey Bulletin

W. V. Price, G. Bohstedt, I. W. Rupel
University of Wisconsin

A GREAT amount of whey is produced yearly as a by-product of the cheese industry but not enough of it is properly utilized in the feeding of livestock. Skimmed whey is an exceptional food for hogs and if handled in a clean, careful manner it can be used for calf feeding.

While whey is over 90 per cent water yet the 6 or 7 per cent of dry matter is of high nutritional value. The protein, fat, milk sugar, minerals, and vitamins making up this dry matter should be utilized to the best possible effect, especially during these war times.

The composition of whey differs slightly because the milk from which it comes is not always alike and cheesemaking methods vary. However, skimmed whey from swiss, limburger and brick cheese factories, even from casein manufacture, is just about the same as whey from American cheese factories.

The whey proteins, although small in amount, are of the highest quality and the most easily digested. They are particularly valuable because they tend to supplement the grain proteins in the ration with necessary amino acids.

Animal protein is more expensive than vegetable protein. When used with liberal amounts of whey in the hog ration the remaining protein may be entirely of vegetable origin.

Albumin is the chief whey protein—it is soluble in water and is not coagulated by rennet. Like casein, albumin contains suitable proportions of all the essential amino acids to support normal growth and reproduction. It is richer than casein in cystine, the amino acid so essential for growth. This whey protein is a valuable supplement for grain proteins because of its peculiar chemical nature.

Milk sugar is a carbohydrate and has nutritive values that other sugars lack. During digestion it breaks down slowly to form an acid reaction in the intestinal tract which is regarded as a desirable condition. Milk sugar favors calcium assimilation which tends to help form stronger bones.

Since it is soluble in water

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practically 90 per cent of the milk sugar is found in whey. As the whey sours, a portion of the sugar is changed to lactic acid.

The minerals of whey, particularly the calcium and phosphorus, are easily assimilated. These are essential for proper growth and bone formation in young stock.

The most abundant and valuable minerals of whey are calcium and phosphorus, although other minerals like sodium, potassium and iodine are present in small amounts.

The amounts of calcium and phosphorus in whey vary with the composition of the milk and somewhat according to the type of cheese made from the milk. In normal cheesemaking about 40 per cent of the calcium and 43 per cent of the phosphorus of the original milk are found in the whey from cheddar cheese; slightly smaller proportions of these salts are found in the whey from swiss, brick and limburger cheese. The differences are small and probably insignificant for practical feeding.

Several vitamins in whey are important in good nutrition. These are found in varying amounts depending on the amounts in the milk as well as upon the cheese-making treatments. Except for vitamin A, which is in the milk fat, whey contains in general a large part of the vitamins found in milk. This fact probably tends to explain the value of whey as a stock food.

Vitamin A is very limited in whey because this vitamin is almost entirely kept in the cheese or is separated from the whey with the small amount of fat left after cheesemaking.

Without Vitamin B1 (thiamin) there is loss of appetite and digestion is not as good. The amount of this vitamin in milk is quite constant, and, since it is soluble in water, a large proportion of it is found in whey.

Vitamin B2 (riboflavin), one of the growth promoting vitamins, remains largely in whey. This important vitamin is essential in the growth and development of animals.

Vitamin C (ascorbic acid), as with all vitamins, is more necessary during active growth. It is water soluble and most of it in the original milk is found in the whey.

There is not enough Vitamin D in whey to prevent rickets when fed to animals.

Other vitamins in lesser amounts are found in whey.

Clean, fresh whey may be used for calf feeding. Since it contains only 0.8 per cent digestible protein, liberal amounts of protein should be fed in the concentrate mixture used with the whey. In Wisconsin experiments, calves fed whey gained less rapidly than those fed skimmilk. However,

the whey-calves did gain better than calves receiving no whey and which were forced to get along on limited amounts of whole milk without special supplements.

The skimmilk-fed calves gained 1.72 pounds daily while the calves on the whey ration gained 1.48 pounds per head a day. While not as sleek nor as large as the skimmilk calves, those receiving the whey were superior in growth and thrift to calves that got neither skimmilk nor whey. The whey used in these experiments was pasteurized, obtained fresh once each day. It was fed in clean pails with no additional effort to keep the whey sweet.

A high protein concentrate mixture (such as the following) is recommended for use with whey until the calves become 5 to 6 months old.

Corn	25 lbs.
Oats	25 lbs.
Middlings	25 lbs.
Linseed or soybean oil meal	25 lbs.
Salt	1 lb.

At that age, if good legume hay is fed, a mixture somewhat lower in protein may be used.

Whey to be used for calf feeding should be pasteurized if all the milk delivered to the factory does not come from tuberculin tested herds.

Whey may at times be satisfactorily used as a feed or drink for mature cattle or even horses but its superior food values are less fully utilized with them than with all ages of swine.

Whey can be used as substitute for mineral acid or molasses in making grass silage. To each ton of grass should be added from 300 to 500 pounds of liquid whey. The grass should be partially dried so that the silage will not be too wet and so that the liquid whey will be absorbed.

Dried whey can also be used in preparing grass silage by adding 35 pounds for each ton of grass.

Concentrated whey (sweet or sour) of 35 per cent solids content can be used satisfactorily by adding it to the grass silage at the rate of 100 pounds per ton of grass.

While dry or concentrated whey therefore makes good grass silage preservatives, nevertheless the present cost of these whey products for this purpose may be prohibitive.

Helpful Broiler Hints

Condensed from American Poultry Journal

G. T. Klein

THERE are times when all the hints possible on management methods are needed. If a page is torn from the notebook of the broiler raiser, there will be hints helpful in any kind of brooding. Here are some of the specifications.

Brooding Units. Rooms 24 by 24 ft. are fairly standard for broiler raising. Each has two stoves or brooding units; 500 chicks to a unit gives good growth and good feed utilization. There are rings of corrugated paper or other arrangements to hold chicks close to the brooder. These rings are made larger and larger as the chicks grow and are taken away entirely when they begin flying over.

There is a run in front of the house. This is safer if the soil is of sandy nature. Brooders are usually brooded in the house or with limited outside runs until market age. Replacement stock goes to range at 8 to 12 weeks.

Brooder Stoves. The coal stove seems to be most popular with broiler raisers, although there are also oil, gas, hot water, wood and electric brooders used in large numbers. All of these sources of heat are satisfactory and most of them have some particular advantage. Broiler raisers pay little attention to thermometers, but they keep the chicks comfortable. Stoves are run when needed regardless of the time of year, but particularly in cool, damp weather when coccidia thrive.

Litter. Sand in combination with sawdust, straw, ground corn cobs, shavings, peat, sugarcane, or one of the several commercial litters are all successfully used. It is hard to list them in order of their value. Built-up litter is used extensively and it gives remarkably good coccidiosis control. The floor covering of 2 inches at the start is built up to about 5 inches by the end of the brood. It is not changed unless serious disease is encountered. Litter is stirred with a fork or rake as it packs and is moved from one place in the room to another if that is necessary to keep it dry.

Range. Some broiler raisers give their birds limited range after 6 or 8 weeks in the brooder house. Range shelters can be used for this housing. This relieves congestion in the brooder houses, and if pasture is good, it cuts feed

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requirements. Where pullets are being raised for layers, it is best to give them range, holding the cockerels in the brooder houses until market size. If the brooder house is needed, the cockerels can be moved to another range.

Roosts. Crooked breasts and breast blisters have been almost eliminated by using no roosts in brooder houses. With a deep litter on the floor, roosts are not needed for 12 or even 16 weeks. If low pits are used in laying houses, it is no problem to get pullets to roost at housing time even though they were not previously trained to use them.

Feeding. Bowel trouble and pasting up have been greatly reduced by starting chicks on chick size grain and grit for 3 days. This system has the disadvantage of giving slower initial growth which is not regained until chicks are 8 to 10 weeks old. The broiler raiser has found a modified plan which works well.

Chicks are fed chick-size grain and grit on papers until 3 P.M. the first feeding day when they have starter mash for the remainder of the day. On the second day, this feeding plan is repeated. On the third day, the chicks have starter mash which is then fed without grain for 6 to 8 weeks.

Gains that can be expected are

4 weeks	½ pound
8 weeks	1¾ pounds
12 weeks	3 pounds
14 weeks	3¾ pounds
16 weeks	4½ pounds
20 weeks	5¼ pounds

Disease Control. The broiler raiser must continuously fight to control disease. Coccidiosis is his most common problem, but by no means the only one. The dry built-up litter is a guard against coccidia. It is an unfavorable place for the coccidia to grow, and they seldom give trouble. When bloody droppings appear or other signs of coccidiosis, flushing must be resorted to. The flushing mash containing milk is the most effective remedy though not universally available now.

Epsom Salts in the following dosages is often used as a flush.

Dosages of Epsom Salts Per 100 Birds

Age	Amt. of Epsom Salts	Amt. of Water
1- 5 weeks	2-4 oz.	1 gal.
5-10 weeks	4-8 oz.	1½ gal.
10-15 weeks	10 oz.	2 gal.
6 mos.	1 lb.	2 gal.

Molasses at the rate of 1 pint to 16 gallons of water fed for 2 days is an effective flush.

Another of the common troubles is ulcerated gizzards, causing high losses and uneven growth in chicks from one week on. Copper sulfate, or commercial preparations containing this chemical have been found to be an effective remedy for it. A stock solution is made by dissolving ½ lb. of copper sulfate (blue vitrol)

crystals in 1 gal. of drinking water. Two tablespoonfuls of this stock solution are used in each gallon of drinking water. It must be fed in wooden or earthenware containers.

Feeders and Waterers. Three sets or sizes of feeders are necessary to prevent wastage of feed from the hoppers. Regardless of design, no feeder can be filled entirely full. Here are feeder and waterer requirements on the 100 chick basis that have worked out well.

Waterers Required

First 2 weeks	one 2-qt. waterer
3-8 weeks	three 2-qt. waterers
8 weeks on	five 2-qt. waterers or automatic waterer

Feed Hopper Requirements

1 to 4 weeks	4 ft. chick size hoppers
4 to 8 weeks	10 ft. intermediate hoppers
8 weeks on	18 ft. large size hoppers

If you would take a tip from the broiler raiser consider these points:

1. There is great efficiency and labor saving by brooding in large rooms.

2. Use the built up litter plan for disease control and labor saving.

3. Use feeders that fit the chicks and never fill them entirely full.

Do You Have to Work So Hard?

Condensed from Farm Journal and Farmer's Wife

Lowell S. Hardin

Purdue University

THERE are many hard ways, and one easiest way, to do every farm job. And twelve State Colleges of Agriculture, headed by Purdue, have set out to find that easier way. They are taking a dozen common farm jobs apart, analyzing every part of them, finding how the most efficient farmers do them, then drawing up a few general principles.

The study sometimes includes even slow-motion movies and the use of stop watches. And these job analysts are getting somewhere. One, for instance, saved a better-than-average Vermont farmer 60 ten-hour days and 700 miles of walking in just one year.

The first object is to get farmers to *question* how they are doing things. Habit, and the way Dad did it, are not necessarily good guides. Put each of your farm jobs up alongside the seven principles listed and you may be surprised at the savings you can make in time and toil.

1. *Does this job have to be done?* What would happen if you didn't do it? Can part of it be left out? One farmer, who had been putting up a board every time he wheeled manure over the barn door sill, finally knocked the sill out. Little savings like this count up and one idea leads to another. If you drive to the hog lot with a load of feed, and then get down to open and shut a gate, and meanwhile try to keep the hogs from running out, maybe you could put the feeders along the fence and fill them across the fence with a chute. Some poultrymen have found that chicken houses do not need cleaning as often as thought.

2. *Can you do it an easier way?* One farmer figured he was spending too much time climbing up and down from the tractor, tugging at a wagon, and finally hooking it up. So he rigged up a long pin with a cross-bar on it. Now he picks up the tongue with this rod, backs the tractor, slips this long pin in and drives off without getting off the seat. Drilling row crops around the field, instead of back and forth, is another "easier way." It saves time in cultivating and harvesting, too. If it looks as if the first cutting of alfalfa will be ready before you have time to make it, turn the stock in and let

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them slow it up for a week or two. One of the oldest "easier ways" is to let hogs pick the corn if you find that you don't have the time or help to pick it otherwise.

3. *Can one man do the work of two?* A sack-holder illustrates how one worker can do what otherwise would be a two-man job (or at least a man-and-woman or man-and-boy job). It is even better to handle the feed in bulk, eliminating sacking entirely, by hauling feed directly from grinder to mixer to self-feeders. Another way to ask this same general question is this: "Can two or more parts of the job be done at the same time?" Many a dairyman makes separate trips to his cows with grain and supplement when he could mix the feed in a cart and do the whole job in one round trip. One man figured he saved 45 miles of walking a year in this simple way. Many farmers pull both disc and grain drill at once, or hook the harrow behind the plow, saving themselves another trip around the field.

4. *Will changing the order of work make it easier?* Often the steps we go thru in doing a job aren't the most logical. For example, many of us start cleaning the brooder house at the door. This means turning with each shovelful and walking over floor which has already been cleaned. By starting at the far corner, the cleaned floor is behind you and the chicks huddle on the clean litter, out of the way. Definite steps in doing chores speed them up, and save going back to do something you may have forgotten. Even on hand-work the order in which the work is done is important. Picking over cotton plants in a systematic fashion, from one side to another, rather than grabbing at bolls hit or miss, speeds up the job. In jobs you do every day, like chores, it's easy to figure out the best order.

5. *Is there a better tool* or piece of equipment? Put loads on wheels. Why lug silage in a tub when you can make one trip with a cart, easier and quicker? Put the cart under the chute so you don't have to shovel it full. A new apple-picking bucket, holding a full box rather than two-thirds of a box, saved a lot of time for some Washington apple pickers. By putting a heavy pane of glass in the combine hopper you can tell when the hopper is full, without stopping, climbing up and looking. An Iowa farmer used a manure spreader to spread ear corn for his hogs. He shovelled it into a portable elevator, with very little lifting.

The elevator loaded the spreader, and the spreader threw it off. Such simple things as cattle-guard types of gates and convenient racks for tools save time and annoyance.

6. *Can you save travel,* by (a) planning, or (b) changing the places where tools, feed, sacks, equipment or animals are stored or kept? Much progress has been made in cutting down the time needed for field work, thanks to machinery, but chores are still a bottleneck. Some farmers have found that they can save extra walking by cutting an extra door, or by providing a feed center near the stock rather than keeping the feed in the crib or granary 200 feet (or a half mile) away. A big enough feeder saves many feeding trips. Placing portable corncribs, or snow-fence cribs, in the clover field at shucking time means that the corn is already hauled when next summer's rush comes on. A temporary slat crib can be made into a self-feeder by removing the bottom slat.

7. *Make both hands work.* Most of us wouldn't hire a one-handed hired man. Yet on lots of jobs our left hand just hangs around for company, or at best merely holds something as a vise would do. In slicing seed potatoes, for instance, one hand usually brings the potatoes while the other just holds the knife. Why not make a board do the knife holding, so both hands can handle potatoes? You will do two or three times as much that way, in the same time. In hand-picking jobs you can speed up the work from one-fourth to one-half if you free both hands by using a special container, or picking belt, on which to hang a sack. Try it next time you pick tomatoes, apples, potatoes, beans, hops or cotton. Such obvious, simple things save time and strength. Yet how few people stop to think of them!

Cornstalk Disease

"Cornstalk" disease, which usually occurs soon after cattle have been turned into fields to pasture the stalks, is less likely to occur when the stalks are broken down, according to the department of animal pathology and hygiene, University of Illinois College of Agriculture.

Although exact causes of this disease are unknown, the effects are rapid and often fatal. Symptoms of cornstalk poisoning are muscular trembling, convulsions and prostration. Prompt treatment by a veterinarian may reduce the number of deaths, but even then the loss may be high.

"Allowing only one or two of the less valuable animals access to the field for several days before turning in the bulk of the herd is a practice followed by some cattle owners to check the safety of the stalk field," the department says.

—Shorthorn World

Untying the Devil's-Shoestring

Condensed from Farm and Ranch

Anna B. Elliott

THE war has caused scientists to turn up the fire under the pot of an Indian medicine man's brew which has been simmering on a back burner since about 1927. Chief cook is V. A. Little, professor of entomology at Texas A. and M. College, and "what's cookin'" is devil's-shoestring, a hardy, native perennial shrub about 1 or 2 feet in height.

Its scientific name is *Tephrosia virginiana,* though no East Texas sandy-land farmer would ever remember to call it anything so polite when he trips on the long, tough, flexible roots turned up by his plow. The future may see the farmers of a special area of East Texas cultivating this onetime bothersome plant and blessing instead of "cussin'" it. Devil's-shoestring grown in this area may prove valuable as a farm crop on poor, sandy land on which corn will yield less than 10 bushels per acre on an average and cotton less than 100 pounds per acre.

The problem of what to grow on this land may be answered by the magic word "rotenone," a subtle, toxic substance present in the roots of devil's-shoestring and considered by some entomologists as the most perfect insecticide known to science because of its deadly effect on a large number of destructive plant and animal pests, but, unlike arsenicals, harmless to warm-blooded animals.

In its natural state, this plant is well distributed throughout the territory extending from New Jersey to Central Texas. Plants in areas other than the East Texas area, strangely are either nontoxic or only slightly toxic, with occasional individual toxic plants. This rotenone-producing area is about 300 miles long and extends from Luling in Caldwell county, Texas, northeasterly to Marshall in Harrison county.

The Cherokee Indians of the Great Smoky Mountains of Tennessee and North Carolina made an ointment of the leaves of *Tephrosia virginiana* to strengthen the hair of the squaws and toughen the sinews of young men. Another member of the *Tephrosia* family was used by the Seminoles as a specific for nosebleed. Many other fantastic medicinal powers have been attributed to this plant. An old Indian trick was pounding devil's-shoestring on a log or

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stake, allowing its juice to run into the water. Fish in the area were quickly intoxicated by the chemical in the juice from the roots of the plant, and soon floated belly up to be easily caught.

Professor Little knew this trick as a boy in East Texas. Fish caught in this manner were not poisonous to man when eaten. Later, when he was at Texas A. and M. College, tropical fish poisons such as derris and cube were beginning to be used as insecticides. It occurred to Professor Little that this thing that they used in East Texas for fish might have properties similar to derris imported from Malaya, cube from Peru, and auhuhu from Hawaii. And so it proved. Coupled with this idea, Little had the thought that the plant might prove a means of a better living for the farmers struggling for an existence on the poor sandy land of East Texas.

Before Pearl Harbor, ships had space to bring derris root, cube and timbo from distant tropical countries. The Japanese conquest of Malaya and the East Indies then cut off our chief commercial supply of this material. Professor Little, true conservative scientist, had not felt his work was far enough along to branch out on a commercial scale with the growing of devil's-shoestring as a field crop. The emergency caused him to decide to plant as a crop his carefully selected strains of the toxic plant which have been bred up to a content of 2½ per cent of rotenone. Wild plants have a rotenone content ranging from practically none to 1½ per cent. Higher yielding strains will be produced later as seed become available, it is believed.

The peculiarity of this plant in producing the toxic substance on the poorest land may provide not only a new source of income for low income farmers on submarginal land, but prove a priceless contribution to American agriculture by producing our own supply of insecticides.

While the project of growing devil's-shoestring as a farm crop looks very promising, it is the policy of officials working with it to take a conservative view of the matter, in so far as solving any rotenone shortage in the immediate fututre is concerned. Conservatism goes with scientific research, and the scientist would not be inclined to bombard the public with broadsides of optimism regarding the possible outcome of any experimental work. However, Professor Little's rotenone baby has kicked out of its experimental plot crib, and is being planted on an acreage basis, where it will be grown under the official eyes of the Texas Experiment Station and the Bureau of Plant Industry.

Many problems are yet to be

worked out. Harvesting the roots presents one of them. It takes three years for the plants to produce a root system ready for harvest. Experimental planting indicates that at least a thousand pounds of dried roots per acre might be expected of mature plants. Labor requirements have run about six man-days per acre to produce a crop, which under field conditions would likely be less. Cost of grinding the roots would be about 5 cents a pound, which ought to be less if they were pulverized in a hammer mill. With derris powder quoted at 75 cents per pound by New York manufacturers, devil's-shoestring would be a good crop at 10 cents a pound, considering the labor involved. Certainly it promises more income per acre than cotton on the same land and with a labor requirement of half that of cotton.

It may happen that Professor Little's meditating about the Indian fishing weed will lead to his cooking up quite a nice pot of insect medicine to control the ravages of pests against food production.

Three-Way Hog Plan

A three-way co-operative hog program has helped swine raising in Coffee county, Alabama. The program started in 1936 when 23 farmers, one from each beat in the county, agreed to ask merchants to help improve the quality of the hogs raised. The merchants donated $230 for purchasing 23 purebred gilts, one for each beat.

Working with county extension workers, the farmers then selected one 4-H club member in each beat to receive a gilt. Each boy or girl getting a gilt agreed to give one gilt out of the first litter to another boy or girl in the beat.

This program has continued until today good purebred boars and gilts are found on practically every farm. Large numbers of sows and boars are being shipped into other counties for breeding purposes. Buyers at stockyards and butchering plants pay premiums for hogs produced in Coffee county. — *Farm Journal and Farmer's Wife*

Agriculture's Decline

Condensed from The Southern Planter

G. W. Forster

North Carolina State College

ONE of the most dramatic events which has taken place in American life is the rapid decline of agriculture. This Nation began its existence as an agrarian society in which farm or rural people dominated its life and determined its national policies. It is true that small tradesmen, large merchants and professional groups exerted considerable influence on national affairs, but, by and large, the country was farm minded.

This condition lasted for more than 100 years after the United States became a "free and independent Nation." During these 100 years the Nation was engaged in the creation, through purchase, exploration and conquest, of a vast and magnificent public domain, the like of which had never before existed. This public domain had mostly disappeared by 1890. It had been transferred to private individuals and there was established a Nation of small land owning farmers. From about the turn of the Twentieth Century the relative importance of agriculture began to decline rapidly and urban forces began to gain the ascendancy.

The ascendancy of urban forces is nowhere more clearly shown than in the shifts in population. "Up to 1820," says one authority, "more than 90 per cent of the working population was engaged in agriculture." This percentage has declined steadily. In 1900, about 42 per cent of the gainfully employed were engaged in farm production. Forty years later, only 21 per cent of our gainfully employed persons were working in agriculture. Thus in a period of 120 years (1820 to 1940) that part of our gainfully employed people used in agriculture declined 77 per cent. Since 1940 a further decline has occurred. Today (1944) probably not more than 18 per cent of our gainfully employed are engaged in agricultural pursuits.

From the beginning of the Colonial period to about the beginning of the Twentieth Century the output of our farms exceeded that of urban industries. From this period on agricultural output, although increasing, declined

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relative to the output of urban industries. For example, from 1899 to 1919 the production of urban industries increased 95.3 per cent, whereas the output of our farms increased only 37 per cent. From 1919 to 1943 the disparity between industrial and agricultural output has become even more pronounced. The index of production for industries in 1919 was 72 (using the production of 1935-39 as a base or 100). By 1943 this index had reached about 200. On the other hand, farm output advanced only from 91 to 128.

The rapid decline in the farmers' share of the national income indicates better, perhaps, than any other index the relative decline of agriculture in the Nation's economy. Accurate information is now available from 1910 when the farmers of the Nation received about 16 per cent of the national income. This share remained remarkably constant, although declining slightly, through the pre-war period of 1910 to 1914, inclusive. It rose slightly during the war, but then declined rapidly. For the five-year period just before the present war, or from 1935 to 1939 inclusive, the farmers' share averaged 9.76 per cent of the national income. And although the farmers' income has increased rapidly during this war, their share of the national income has not changed materially.

It is significant to compare the farmers' share of the national income with the percentage gainfully employed in agriculture. The gainfully employed in agriculture in 1910 was about 32 per cent of the total working population of the Nation, and those so engaged received about 16 per cent of the national income. In 1940, 21 per cent were gainfully employed in agriculture and received only 8.38 per cent of the national income. Stated another way, about one-fifth of the Nation's gainfully employed were getting less than one-twelfth of the national income.

This division of the national income may not be unfair although it certainly looks that way. The reasons why caution is necessary may be stated in this fashion: The composition of farm and non-farm populations is not strictly comparable. No doubt there is a larger number of skilled, professional, and semi-professional workers in the non-farm working population than there is to be found in the farm working population. To the extent, then, that this is true, the non-farm population may be contributing a larger share to the total national income than farm workers, and for this reason, should receive a larger share of the national income.

The second reason why caution is necessary is that the percentage

of children working on farms is much higher than that working in the city industries where laws against child labor are rigidly enforced.

The third argument, and perhaps the most logical, is that dollars received by the farm workers buy more than the dollar of the city worker. Obviously these arguments possess validity, but how true they are is difficult, if not impossible, to determine.

The relative decline in agriculture in the Nation's economy raises more important questions than whether or not agriculture is receiving its fair share of the national income. The first of these affects the future of our republic. Is there a proper balance which should be maintained between rural and urban life? This question is not simply rhetorical, but of signal importance. It has been pointed out that the cities depend upon the farms and small rural communities not only to maintain their population but also to insure the growth of cities which is dependent upon migrants from rural places. Then, too, there is the question of social stability. Can a nation reman stable and free from economic and social upheavals if the masses are city-bred and city-raised? Or is it essential that the reactionary and less stable city population be neutralized by a more conservative rural people? Then, too, the question of the supply of food and fibers immediately arises. Should not a strong and vigorous farm population be maintained to assure the Nation of an abundant food supply and fibers needed in the manufacture of a large variety of essential products?

These and many other questions arise, and others will arise to plague out statesmen. It all adds up to one essential—that our statesmen and farm leaders must be better qualified by training and experience than those of the present if these questions are to be answered intelligently.

Five Farmers Make a Plan

Condensed from Soil Conservation

P. A. Waring

FIVE farm families live in Honey Hollow. We own and work our places singly and separately, but during the last 4 years we have discovered an important fact about the stream which winds across our land. We have learned that it binds us together, and gives us a common problem. And as we have come to understand this fact a new approach to our farming has developed.

Honey Hollow Creek starts up on the hill on Frank's land, crosses and drains Forrest's farm and Stewart's farm and then flows through the valley where Charlie and I live. All in all, our watershed has in it about 840 acres of farm land and woods which have been in use for about 200 years or more. We are poultrymen and dairymen and general farmers, and one of us recently has begun to raise steers. In general, in our neighborhood, most farmers practice the same kind of agriculture, and though only one of us actually inherited his farm we have all been living here for a good many years.

The county in our neighborhood is rolling, but none of the land on our farms can be said to be steep. However, for a long while we have known that there were gullies here and there, and thin spots where crops grew badly. I suppose if the creek had not eventually filled up and flooded all the bottom land, we would have gone on for a good many years in ignorance of the problem that we now know is pretty serious. But the creek came to give us a real headache, and we were forced to learn our lesson.

The upshot of this situation was that we went in for erosion control. We went in for stopping the obvious silting in of our stream, and the now obvious fact that this silt was the soil fertility upon which we were trying to build our homes and our farms. We went in for, at least, thinking about the problem and planning the work together. The stream had taught us that. The stream had shown us that we did not own five separate parcels of land, but that in a sense these five farms belonged together, as far as understanding the problem of erosion was concerned, and the job of planning for its control must be a single job. Frank had said one day when we met to talk over what we would do: "You

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fellows down there in the valley can't solve the problem by yourselves. Your trouble really starts up on my farm where the creek rises. We will have to solve it together."

And Frank was right. After four years of planning and working together on this problem we know that as far as the control of erosion is concerned we have to think in terms of our watershed, and not in terms of five separate farms whose boundaries really bear no relation to the shape of the land. If you should come to Honey Hollow today you would see that we have made a beginning. You would see that all our crop land is now plowed and planted on the contour, and that we are following a general plan laid out for the whole 840 acres. Of course we each do our own work, except now and again when we lend a hand to one another on some special job. But we have planned the way to handle our land together. And there have been good results. Gullying has been greatly reduced, our stream no longer goes quickly into flood, endangering crop land, and already we are beginning to see increases in the yield per acre of our crops.

This experience has in turn taught us something else. We are beginning to see that perhaps there is a bigger job than erosion control which we can think about and plan together—a job of which erosion control is but a very important part. We are beginning to see that it is possible to build a permanent agriculture here on our places, and that perhaps this means doing a whole lot of things besides those which we are now doing. Perhaps it means more than better pastures, better rotations, better relations of our livestock to our cropping, contour strip planting and terracing; perhaps it means the development of wildlife conservation for our whole area.

Most farmers sooner or later learn the value of birds in the production of crops. Few of us do anything about it, for we are usually so busy with the immediate job of earning a living that we never get to doing what we know would be wise and good. Moreover, it is sometimes difficult to figure out what one family can do on one small farm.

Over the years the cropland on our five places has been widened, the woods areas further separated, the hedge rows cleaned up. All of this has tended to reduce the cover for wildlife. We and our forebears have done this to get more land for crops and thus earn more money. Most farms hereabout have gone through this process. Bird life has suffered, and if the fact were faced by most of us, our pocketbooks also. But the fact usually has not been faced, and we farmers in Honey Hollow

are no exception. We have felt that we simply did not have the time to plant hedgerows and to redevelop cover, along with the pressing business of caring for stock and planting and harvesting grain. Not until recently did we stop to consider whether we could afford to neglect this side of farming if we were to develop a really permanent agriculture.

Now, in the business of planning for erosion control we had drawn a map of our five farms and of the stream which drains them, the woods areas which dot them here and there, and the existing hedgerows. Our map showed us what we had and what we did not have. It was easy to see that the wooded areas were not connected, that there was no continuous cover for birds, that crop land on the whole was in wide open spaces uncut by hedgerows.

It is sometimes easier to see the whole of a situation by looking at a map than when walking about your farm. And it certainly helps in grappling with a problem like this one, which covered five farms and not one. At any rate the map visualized the matter. And as is often the case, the difficulties did not seem so great when we began to think about them together as when we had tried to think them through separately and alone. Moreover, we had learned the value of cooperation from our erosion control work and were more ready to tackle what proved to be an expansion and development of the watershed conservation plan.

The result of all this business, which went on for about a year, is that we have made a plan. Without a plan, we know that we should get nowhere. With it, we have a goal to strive for. Our plan sets no limits on finishing our project, for we knew we would have to work within our capacities of time and strength and money. But we agreed to do our best, each on his own place.

We asked the Soil Conservation Service to advise us. We set as our aim in planning a wildlife project the association of this with all the other things we might do to build a permanent agriculture for Honey Hollow. Conserving had meaning only when undertaken by us as farmers and as part of our agriculture. It is, after all, not something separate and distinct in itself, but an integral aspect of a plan for proper land use.

The framework of our plan, as shown on the map, lies in developing continuous cover for wildlife throughout the whole watershed, where farm woodlot is connected with farm woodlot by field border hedges, and by contour hedges of berry-bearing and nut shrubs, and nut and fruit trees, and conifers for winter protection.

These hedges, along with islands of shrubs grown in the nooks and corners of our places least desirable for crops, will provide travelways, food, shelter, and nesting sites for birds and some small animals, and will serve to break up the large sections of crop land.

Our idea is not to develop a project from the standpoint of game management, but to conserve wildlife for the sake of better land use, the sake of our crops. We have begun to realize that we farmers have unbalanced nature by our neat clearing of land, and that the old ecology is gone in most agricultural areas. We have come to realize this with sorrow as cut worms, beetles of many kinds, and many pests which attack the farmer have increased. Whether a return to normal of the bird population will solve our difficulties we are certainly not now prepared to say. But it seems logical, and the work of such agencies as the Audubon Society and of the Department of Agriculture would certainly point to the fact that it is desirable from every standpoint to try to bring about a return of the balance in nature.

Subdivisions of our Honey Hollow project are as follows:

1. Planting of hedges and shrub islands.
2. Planting of woodland edges.
3. Planting of windbreaks, roadsides.
4. Stream development for better wildlife and farm use.
5. Increasing of field edges by breaking up large fields into contour strips of crops.

It is clear to us as we look at our plan that there is much to do in planting this cover and in developing our stream. But we know that we do not have to finish it in one year or two. Moreover, some of it we have already accomplished by converting square fields into contour stripped fields and thus increasing the field edges which will tend to bring small birds out into the open areas more than heretofore. And some gains in work will lie in allowing hedges to grow up and thicken rather than keeping them clean.

Nevertheless, there will be a good many shrubs and small trees to plant and this will take time and labor which will have to be spread over some years. The Soil Conservation Service has agreed to help us by supplying some free or low-cost nursery stock because it is interested in the cooperative aspects of our project.

This is our plan. We have already made a beginning with it. Last spring we each planted a hedgerow, some by thickening an old and established row, some by beginning a new one on the contour, and all by following the plan upon the map. We can mark off a little area of accomplish-

ment, and we have learned something about our capacity to do this work, even in the busy spring season. We are following the advice of the Soil Conservation Service in the selection of planting stock. We are also seeking knowledge from such fine books as William R. Van Dersal's *Native Woody Plants of the U. S., Their Erosion Control and Wildlife Values,* and the National Audubon Society Circular by Peterson called *Trees, Shrubs, Vines for Attracting Birds.*

Trees and shrubs grow slowly. It will be years before we have a showing for our work. But we know this. The cycle of farming is always long, and we have learned to understand this fact over the years. Nevertheless, we have the confident feeling that something is started that is good and in the direction of permanent agriculture for Honey Hollow.

Squabs

He has the biggest squab farm in the country. That's Richard Dyer, Newfield, New Jersey. He has around 9,000 pigeons, and he kills and dresses 1,500 young squabs for market every week.

"Squabs are simple to raise, too," says Mr. Dyer. Of course, he has been at it so long that it ought to be simple for him. He started with 14 pairs of breeders in 1914.

Long considered a delicacy, squabs have another talking point in times when meat is scarce. One pair of birds will produce 12 or 14 squabs a year, and the squabs are ready for market in four weeks, weighing about a pound. A pair of birds will continue to breed profitably for five or six years.

On Mr. Dyer's farm, the pigeons are kept in long rows of pens. Each pen, 10x12 feet, holds 40 pairs. One side is all glass and open to the sun and air.

Both parent birds help to raise the young. They take turns sitting on the eggs. For the first several days, young birds are fed by both parents with regurgitated feed from their crops. After that, the male bird feeds the young—a mixture of corn, wheat, peas and kafir corn. A pair of breeders and their young will eat about 100 pounds of grain a year. The birds line their own nest bowls with hay and tobacco stems.

After killing, Mr. Dyer picks the squabs, puts them in tanks over night, then packs them in ice the following day for shipment to New York, Philadelphia and other nearby markets. He sells the manure from his plant to nearby truck and fruit farmers.

—Farm Journal

A Pattern for Ownership

Condensed from The Ohio Farmer

Ray T. Kelsey

A few weeks ago I was privileged to meet a group of young farmers who were unusually enthusiastic, wide-awake, hard-working boys. There were 24 of them and they were each operating an 80-acre farm out in Arizona. Eighty acres doesn't sound like much of a farm especially out in the wide-open spaces of the West but when it is under irrigation it can mean quite a farm. And these boys were making those acres produce to a fare-thee-well.

When Paul W. Litchfield, the chairman of the Goodyear Tire and Rubber Co. board, invited a few of us to go out with him to visit his Apprentice Farmer project that he had started seven years ago on the Goodyear Farms we couldn't help but wonder if it might not be just another colonization project of the modern paternalistic type.

Although it might be called a pet project of Mr. Litchfield's, he started it and has kept it on a strictly business basis. He gives these boys nothing that they do not earn and they do not expect it. If they need money he will loan it to them but they pay the going rate of interest. It is a cooperative arrangement between Goodyear and these youngsters who want to own their own farm some day. The boys can ask for advice and they get it in a friendly way but they do not have to take it, as they are on their own. It startled us a bit when they casually called this industrial magnate who is treated with extreme deference in big business by the simple nickname of "Litch." And he calls them by their first names, too, but they get no extra favors on account of that.

In these days when we hear the statement often made that it is impossible for a young man without financial resources to buy and pay for a farm it was refreshing to see a group like this who are doing it. True, it is operating according to a plan that was thought out in advance and it takes some capital for backing but it is not a "give-away" proposition that so often destroys ambition and initiative. Here's how it started and how it works:

Back in 1917 Goodyear bought 35,000 acres of Arizona desert land, that could be irrigated, for

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the purpose of growing long staple cotton which they needed for tire cord and could no longer import from Egypt due to World War I. Later they found it wasn't needed for cotton production so they developed it into a general farm that has been very successful.

But this big company is primarily in the tire-making business, not farming. So Mr. Litchfield conceived the idea of getting some of this land into the hands of young farmers to own and operate themselves. It is his belief that the best citizen is the one owning his own home and his own land. Several years ago he was asked to serve as one of the judges to select the Star Farmer of the FFA. He got interested in the organization and that gave him his big idea. Why not give a group of boys like those FFA boys the opportunity to own some of those Goodyear acres?

So a plan was set up and started. Under it an applicant to be accepted must have a definite interest in agriculture and a desire to own a farm. An agricultural background is preferred although in one instance a city-reared youth was accepted and today is one of the most successful members. There are no financial requirements. Applicants from well-to-do families are not accepted. Many have started from scratch and a few have even been in debt when they arrived.

A new member starts as an employee of the big farm, working nine hours a day on a monthly rate. He is encouraged to acquire a small dairy herd which he manages on the side. The company usually finances the purchase of the first three cows.

As soon as the newcomer demonstrates he is qualified for more responsibility he is permitted to cash lease an 80-acre tract of irrigated land reclaimed from the desert. A house is provided and the company furnishes capital outlay which is charged to that piece of land. Purchase of essential machinery is financed, a mortgage being taken on the stock, machinery and crops.

He is then a full fledged Apprentice Farmer and continues on this basis until he has accumulated a net worth of one-fifth of the purchase price of the 80-acre plot, usually the one which he has leased. He then is eligible to purchase on a 15-year contract.

The group has a governing body called the Council and it is composed of three elected representatives of the boys, three officials of Goodyear Farms and L. D. Klemmedson, Arizona state Vo-Ag director, who is one of the biggest boosters for the entire program. The Council takes up matters affecting the boys as a whole and any individual problems that can't be settled among

them. It also accepts applications from others wishing to join. It determines when an apprentice is eligible for cash lease and purchase. Meetings are held once a month. The Apprentice Farmers also have a weekly discussion group in which all participate, considering problems common to the group. Educational phases of the work are studied and discussions held on budget problems and bookkeeping.

Social affairs are held frequently for all members of the families. All but two in the group are married although when the project was started only single men were accepted. At the end of the first year permission to wed was given those requesting. Within a short time three married school teachers from the community. Others returned to their former homes, married their old sweethearts and brought them back. Today there are 27 children in these homes.

Fifty-four boys, mostly members of FFA, have been accepted as members since the project was started in 1937. Fifteen of that number have enlisted or were drafted into the armed forces since the war emergency started, including one who lost his life in the Southwest Pacific. Most of those in military service are expected to take up where they left off as soon as they are released to civilian life again.

While we were in Arizona we attended the "commencement exercises" for seven of these Apprentice Farmers when Mr. Litchfield presented to each the land contract for his farm. The boys realized that it was only a "commencement" too, as that was the time when they really commenced to pay for the farm. But the experience and the training they have already had has given them confidence and they know that it isn't a hopeless job. Some day in the not-too-distant future they will have it paid for, they will own their home and farm, and they will be their own boss.

It's a pattern for ownership of land and homes for deserving young men who have no financial resources and who sincerely want to be farmers.

Hybrid Corn Takes Over

Condensed from New Jersey Agriculture

Gilbert H. Ahlgren

Associate Agronomist

CORN is a native American crop, which history credits Columbus and his sailors as being the first white men to see. The early colonial settlers at Jamestown and Plymouth were saved from starvation by corn, the cultivation and care of which they learned from the Indians. Today this crop forms the backbone of the American livestock industry. Grown in every state, the 100 million acres planted annually are of greater economic importance to our agriculture than is the combined value of all other cereal crops, including wheat, oats, barley, and rye. In 1942, American farmers produced more than 3 billion bushels —the largest corn crop in our history—about 80 per cent of which was fed to livestock. The rest was sold for industrial purposes and human consumption.

The present widespread popularity of corn is due to the hundreds of outstanding varieties that have been developed and that permit the growth of the grain under varied soil and climatic conditions. Under favorable conditions corn produces a greater yield of grain and of total digestible nutrients per acre than any other crop now grown.

But corn has not attained these advantages over the other grain crops by haphazard chance. The first white settlers in America found the Indians growing native varieties of flint, flour, sweet corn, and popcorn. The Indians also had some dent corn but this was found only in very restricted areas. One of the white man's greatest contributions to corn growing is the development of hundreds of varieties of dent corn making it the most widely grown and popular type in America today.

Since the time of the early American colonists, growers have attempted to select and breed corn for higher production, better adaptation, superior ear type, and many other characteristics. The first method of improvement may be called "mass selection." This involved the selection of seed from superior plants in the field and the bulking of this seed for planting the next year. Results were limited by the judgment of the grower in making selections,

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by the degree of superiority of the best plants, and by contamination with pollen from inferior neighboring plants. In spite of these limitations many important varieties of open-pollinated corn were developed by this procedure.

A second method of improvement was "ear-to-row selection." This involved selecting superior ears, planting a portion of the seed from each ear in a separate row, and measuring the yields of the resulting plants. The remainder of the seed from those ears which gave high yields was saved and planted the following year. This technique, though promising at first, has proved disappointing over a period of time. Only the seed parent side of the parentage is controlled by this method, since it is impossible to tell the characteristics of the plants which pollinated the ear. In addition to this, selection toward a certain type involves inbreeding to some extent, and this introduces some loss in vigor.

Controlled pollination of open-pollinated varieties was still another method employed, but one practiced only by professional corn breeders. Pollen from one desirable variety was placed on the protected silks of another. The resultant plants from such a cross were selected for superior characteristics and propagated to form new varieties. This method was superior to the first two, since controlled pollination meant that both the seed and pollen parents were known, and more uniformity of type resulted.

It was not, however, until the discovery of the principles of hybridization that modern corn breeding came into its own. Based on the science of genetics, hybridization is perhaps the outstanding example of revolutionizing the production of an agricultural crop by scientific research.

In 1905 Professor G. A. Shull, working for the Carnegie Foundation at Cold Harbor, N. Y., discovered this new way of breeding corn. At that time he was engaged in a purely genetic study of the effects of self-pollination and subsequent crossing. Professor Shull's notes on the increased vigor of the hybrids he produced by this technique aroused considerable interest among plant breeders, one of whom was Professor E. M. East, then at the Illinois Agricultural College. Later, at the Connecticut Agricultural Experiment Station, Professor East expanded his research on corn breeding, and, following Shull's method, produced inbred lines from which he made hybrids, subsequently proving their superiority over ordinary open-pollinated varieties. This work of Shull and East opened a new era in corn variety improvement.

A number of serious problems

had to be solved before the farm use of hybrid corn became practical. The single cross procedure of producing seed was very costly when the yield was balanced against the labor involved. Then again, the kernels produced by crossing two inbred types (the single-cross technique of Shull and East) were small and could not be seeded evenly by the ordinary corn planter. Hybrid corn, therefore, was for a while only of scientific interest. In 1919, however, Dr. D. F. Jones, of the Connecticut Agricultural Experiment Station, suggested making double-cross hybrids, a process involving crossing or hybridizing two single-cross lines, and many of the drawbacks of the single-crossing were eliminated.

The production of hybrid corn involves a long-time breeding and testing program. It is a relatively expensive procedure, requiring land, labor, and the services of a trained plant breeder. It is ordinarily conducted, therefore, only by state agricultural experiment stations or by large seed companies. A corn breeding program usually begins with the collection of a large number of open-pollinated field corn varieties. Available hybrids of various kinds may also be utilized. The collection of breeding materials from a large number of sources is desirable since it assures a wide genetic base, which is helpful in securing hybrid vigor when inbreds are re-combined.

Inbreds are produced by a process known as selfing, or inbreeding. The pollen factor in corn is produced by the tassel; the ear is the seed part of the plant. Corn is a naturally cross-pollinated plant; that is, pollen is carried by the wind from the tassels of various plants to the silks on the ears of other plants, thus effecting cross-pollination. Selfing consists of taking pollen from the tassel and placing it on the silks of the same plant which produced the pollen. If this process, accompanied by careful selection, is continued for a number of years, a pure line of corn will result. Inbreeding results in smaller plants and lower yields, a condition described as loss of vigor. This change in plant vigor does not disturb the breeder since he knows vigor will be restored when proper crosses are made.

Selfing usually continues until all plants of a line are exactly alike in their outward appearance, the pollination being controlled by covering each earshoot with a glassine or parchment bag before the silks appear. This bag is removed to enable the breeder to sprinkle pollen on the silks, and then it is replaced for further protection. After pollination has been completed a brown paper bag is placed over the earshoot and the protective glassine bag.

Proper labels for identification are then attached to the paper bag, and the ear is permitted to mature within its covering. After inbreeding has proceeded from three to five or more years, the lines should be relatively pure genetically and then the breeder is ready to proceed with crossing or hybridizing.

As stated previously, hybrids may be produced by crossing two inbred lines; that is, taking pollen from one line and placing it on the silks of another. This is known as a single cross. It is sometimes practical to make three-way crosses in which three inbreds are involved, or double crosses in which four inbreds constitute the parentage. The double-cross is the method used for hybrid seed production by most commercial growers. After the hybrids are produced it is necessary to test them against standard varieties for several years to establish their comparative value. Those hybrids which appear superior are then planted in statewide tests to determine their range of adaptation, during which time the inferior varieties are discarded. Experiment stations have tested thousands of hybrids by this general procedure. A large number of superior inbreds have been developed and are being extensively utilized in new hybrid combinations.

Many may wonder why hybrid corn has become so popular with American farmers. Fundamentally the answer is one of economics. Hybrid varieties usually out-yield open-pollinated types by as much as 10 to 30 per cent, and in addition are much more uniform and often possess such characteristics as increased leafiness and greater resistance to drought, lodging, and insect and disease infestation.

Hybrid corn is much superior to open-pollinated varieties, but, like any other crop, it will give best results only when provided with favorable growing conditions. Corn does best following a sod crop, and adequate lime and fertilizer should be provided. A well-prepared seedbed plowed to a depth of at least 7 inches is desirable. When possible, corn should be planted in early May in rows 3½ feet apart on medium soil, and 4 feet apart on light soil. Three plants per hill will give best results when check-planted. When drill-planted, single plants should be spaced 12 to 14 inches apart in the row. It is desirable to plant the seeds 2 inches deep in sandy soils, and 1 inch deep in heavier soils. Weeds should be controlled by thorough cultivation.

Hybrids now dominate the corn acreage in this country; approximately one-half of the 100 million acres planted in the United States in 1943 consisted of hybrid varieties.

No other crop has shown its superiority so definitely as has hybrid corn, nor has any other been adopted so quickly by American farmers. Hybrid corn is still in its infancy, but as scientists continue to forge ahead in their program of crop improvement, agriculture can look forward to even better hybrids than those now available.

Discovery Saves Waste Feathers

Condensed from New England Homestead

SUCCESSFUL research by the Department of Agriculture will make possible the salvage and industrial use of millions of pounds of chicken feathers formerly wasted or used as fertilizer. Wetpicked feathers, a by-product of chicken-dressing plants, normally decompose too rapidly to permit their shipment to feather-processing establishments.

A practical means of preventing this loss has been developed by Dr. J. I. Hardy, a scientist of the Department's Agricultural Research Administration. He found that a combination of two weak acids will preserve wet feathers satisfactorily without injuring their fluffiness. The preservation is made in the proportion of 0.55 pound of salicylic acid, 1.1 pounds of benzoic acid, and 30 gallons of lukewarm water, well stirred to dissolve the chemicals completely.

In one test of the method, twenty pounds of wet chicken feathers that were thoroughly soaked in this solution and then removed showed no sign of decomposition atfer more than a month. In contrast, untreated wet feathers had a disagreeable odor and became infested with maggots two days after being plucked. The cost of the chemicals used in the treatment is small compared with the value of the feathers.

The discovery makes possible the salvage of chicken and turkey feathers from poultry-dressing plants throughout the country at a time when they are needed to supplement inadequate supplies of duck, geese and other waterfowl feathers. Among other uses, feathers are excellent as camouflage material. New methods of curling, processing and otherwise treating chicken feathers have greatly increased their suitability for sleeping bags, pillows and other uses.

Soil Rebuilds Soldiers

Condensed from Southern Agriculturist

Edith Bell Love

"YOU can count the returns from the cabbage and potatoes—but there's no way to value benefits to the boys!" Thus speaks the chief surgeon of the post hospital of Camp Gordon, just outside of Augusta, Georgia.

Colonel Charles C. Demmer has conducted what is probably one of the most unusual experiments with convalescent patients ever tried at a U. S. Army camp.

It started last spring when all the talk was about Victory Gardens. The Colonel caught an idea for soldier gardens. He realized what it would mean to his convalescent boys to have them working outdoors in the high, invigorating air of the Georgia hills.

Colonel Demmer has been a surgeon in the U. S. Army for 35 years. His hobby definitely was not gardening. But, with the Colonel, to get an idea was to act on it immediately. He discussed his plan with the Post Commander, who agreed to furnish land and such facilities as were available.

Since the farm was about nine miles distant from the post hospital and from the camp proper, arrangements had to be made for the patients to live there.

The first step was to put the buildings in order, largely through scrap materials. A serviceable windmill was salvaged on the reservation and the well put in condition. A modern septic tank and sewage disposal system was installed. A three-room house was moved from its site a mile distant and prepared for the medical officer on duty.

The community house was converted into a barracks, with one large room for a recreation hall. A field kitchen with incinerator and other sanitary field devices was added. There was also a barbecue pit and an open-air grill, And — this really pleased the Colonel — an old-fashioned root cellar.

When all was in readiness, 30 convalescent patients were moved from the post hospital to the farm. A medical officer, cooks and kitchen police were assigned to duty there.

The boys were enthusiastic. They started off with light tasks suited to their strength. None of them had to plow. That was done with mule-power by the only

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hired civilian. The farm started off with 33 acres. It ended up with 100.

The returns read like a report on a bond sale drive.

The garden was begun in April. By the end of July the crops harvested represented a total wholesale value of $6,603.99. Expenditures were $2,936.19. The total net profit was $3,667.80. And it must be remembered this represented only the early crops. The later crops of sweet potatoes, corn and other late vegetables were not counted.

The vegetables were everything in the plain and fancy varieties grown in Georgia. There were four miles of running butterbeans. Fields of eggplants that looked like cannon balls. Potatoes by the ton. Interminable rows of corn.

The post hospital and the hospital mess were kept supplied with fresh vegetables and melons all summer, and none of the surplus was wasted. Canning facilities in the hospital kitchen put up vegetables in vast quantities for winter use. The 1,500 gallons of turnip greens will give you an idea of the volume. In addition to his canned vegetables, Colonel Demmer dehydrated a considerable portion of his excess crops.

As soon as the summer and fall crops were gathered, a winter garden was planted.

But the greatest accomplishment in Colonel Demmer's experimental farm is its results on the patients. The sunshine and fresh air and clean outdoors immediately had effect. Physical improvement was miraculous. In a very short time the boys were sound and husky and brown as Indians. There was only one drawback — if you could call it a drawback: the patients became well too fast, and had to make way for another shift.

The Colonel is proud—as well he might be. In fact, he is still constantly astounded at his first experiment in farming. But it is of his boys that he's proudest of all. Their quick recovery and bounding health and strength have more than justified his belief in the curative effect of gardening.

Grassland Agriculture

Condensed from Pennsylvania Farmer

Fred Grau

Pennsylvania State College

GRASSLAND agriculture is the basis for agriculture as well as the ultimate agricultural goal, particularly in the northeastern states.

Nowhere in all my travels have I observed such rich potential opportunities in grassland agriculture as exist in Pennsylvania. As a small boy in Nebraska I recall helping my father prepare beautiful sheaves of native and introduced grasses for fair exhibits. Our farm was one of the first in the region to grow brome grass for summer pasture and for erosion control. One fence row of brome grass buried three fences, one on top of the other, catching and holding the eroded topsoil. Later, in college, the interest in grasses developed further through the job of caring for plant nurseries at the University of Nebraska for two years. A study of Maryland pastures in 1934, followed in three years by a three-month visit to centers of European grassland agriculture, further strengthened the firm belief in grass as the basis of all agriculture.

The tremendous importance of grass in fields other than agriculture cannot be overlooked. A year spent with the U. S. Engineers on grassing of airfields and military establishments did nothing to curb my enthusiasm for more knowledge of grass in all its uses.

Fundamentally, a grassland program is diverse. Included in its ramifications are the uses of grass (and associated small-seeded legumes) for functions seemingly unrelated in pastures, hay fields, lawns, parks, cemeteries, airfields, golf courses, human food, roadsides, windbreaks, cover crops, green manure, living snow fences, water courses and others. In fact grass, more than any other living group of plants, is so necessary to mankind in so many ways that it is taken more or less for granted.

In developing a grassland program, the testing of all known existing species and strains which may find adaptation is of first importance. Adaptation must be studied in relation to uses, to soils, to climate, and to fertility levels and management practices. After adaptation comes suitabil-

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ity for the purpose. A plant may be adapted to the soils and the climate but not to the existing management practices. Slight but significant changes in management may develop unsuspected possibilities in the plant in question. Mixtures with other plants may develop unknown characteristics and improve undesirable ones. An excellent example of this is the splendid combination of orchard grass and Ladino clover.

When I first started talking orchard grass-Ladino clover mixtures I was ridiculed by most farmers who looked upon orchard grass as something no self-respecting cow would eat. Those that came to scoff have remained to sing the praises of the happy marriage of these two plants. This mixture, so ideally adapted to our climate and to our soils for pasture, did not fit our pasture management systems, so changes had to be instituted. All of this takes time to (1) find the plants, (2) test them, (3) then educate the farmers to use them to the best advantage. The process is practically continuous. The plant breeders are hard at work developing improved strains of forage plants with more leaves, finer leaves, greater winter hardiness, greater yielding capacity, more disease resistance.

In the search for superior plants it has been discovered that the very best we can get may be growing right here at home! This is presently the case with red clover. Figures released recently show that certain strains of red clover home grown for many years outyield all red clovers from all sources. This being true, certainly other forage plants may be doing the same good job of adapting themselves but because we have not searched we have not discovered this fact. For example, a real possibility exists in a study of the many patches of orchard grass which grow in orchards or in fence corners or waste areas. Some, I am told, have been there for fifty years or more. Truly a rich source of material. Many other examples could be given.

To my knowledge no grassland area in the state has been treated and managed to yield the maximum returns. Some approach this ideal closely but, in general, the level of production of existing stands is low. There has been no intensive study of the yield potential of our grasslands. Only in a few experimental plots has fertilization been sufficient to eliminate nutrients as a limiting growth factor. And nowhere in Pennsylvania, to my knowledge, has irrigation been supplied to grassland under maximum fertility conditions to achieve the yield potential that is possible. With the advance of civilization it will be mandatory to know how

the maximum yields can be obtained and only research can discover the truth and find ways to make it an economic possibility.

Fundamental to an overall grassland agriculture is the production of the seed with which to establish and to renew the stands. A research program on seed production of adapted species should parallel the testing program for adaptation and value for specific purposes. Thus, when it is determined that a particular species will be recommended, it will be possible to provide adequate supplies of the seed of superior germ plasm within the shortest space of time. The only way this is possible is to know how and where the seed can be produced in the greatest quantity in the least time, while preserving intact the integrity of the superior seed. Without this knowledge, the program will fail.

What are some of the so-called "new" forage plants which still await discovery by the people who need them most? Not all can be mentioned here, nor need they be, but a partial list includes the following:

Alfalfa: An important and valuable crop but short-lived under most conditions. New certified strains being increased by Crop Improvement Associations are the wilt-resistant Ranger, Buffalo, and Atlantic.

Red clover: Local strains from Lancaster and Berks counties in Pennsylvania outyielded any currently-known sources of seed. Seed is at a premium today because practically none exists—and Pennsylvania farmers use over seven million pounds each year. Seed-producing possibilities are good.

Ladino clover: A newcomer but a lusty infant. It is a must for poultry ranges and for high-producing dairy pasture, hog pasture, sheep pasture. Seed at the rate of 100 pounds to the acre has been harvested from one-year-old stands with little loss of total tonnage of high-quality feed. At present prices of $1.75 a pound further investigations should be stimulated.

Birdsfoot trefoil (also called Lotus): As nearly a permanent legume, once established, as we know. Stands improve from natural reseeding. Its adaptation is virtually unknown. Adapted to poor soils and close grazing, and superior for erosion control, it should take a number one spot in future investigations.

Crown vetch: Native stands in Berks and Schuylkill counties are believed to be 30 years old or more, never have been plowed. Unpalatable to cattle but may be a rich source of extracted protein. Unexcelled for erosion control. Surely a rich potential.

Orchard grass: One of the best-known and most-reviled of the

grasses, yet one of the most tenacious and highest-yielding. Its marriage to Ladino clover has caused it to be one of the best-liked of the grasses. Plant breeders have new strains for special purposes, as yet undeveloped. This is number one among the grasses for broad research. Seed production is promising.

Brome grass: Little known in the East, it is an old-timer in the Middle West. Native stands occur in all parts of the state, one of the greatest possibilities for the future Southern-grown strains do best at State College but statewide adaptation is unknown. A must for investigations. Certified strains from fifty-year-old stands now available through crop improvement associations in some states.

Red and Chewings fescue: Widely used for turf and erosion control cover on non-agricultural sites where organic matter content of soil is very low. Known to be adapted to most of the state, seed production is a paying farm crop on some 300 acres, is expanding largely on waste or abandoned tillable land.

Alta fescue: Recently introduced from Oregon where it is a favorite for hay and pasture and for turf purposes on airfields, it has not found favor here in Pennsylvania in comparison with grasses now grown. Limited tests indicate adaptation but its most effective use has not been discovered.

Tall oat grass: Frequently observed on roadsides on poor soil, it has recently found favor in the southeast with legume mixtures for forage. Potentialities are undeveloped.

Not complete by any means, the list of possibilities in a broad grassland agriculture looms large indeed—a rich field for investigation. Scarcely mentioned are the needs of grass for roadside development for the miles of highways contemplated in the Post-War period; grass for the recreational facilities of our people. Farm chemurgy, chemistry applied to agriculture, ultimately will develop new uses for the virtually inexhaustible supply of material which can be produced each year and every year from GRASS! No other crop protects and builds the soil so well while it produces. Therefore, I submit that grass is the biggest single factor in a rich and prosperous agriculture. Witness the death of civilization long past. Evidence is strong that, when the grass failed, Life failed. Then let more and more emphasis be placed upon all the phases of a Grassland Agriculture not only for itself but for its untold benefits to all mankind.

Raise That Extra Pig!

Condensed from American Hampshire Herdsman

Al Severson

FARROWING time in a broad sense is the hog breeders' harvest season. It is very largely at that season that he measures the yield of his pig crop which he can reasonably expect to sell in the fall and winter. More than in any past year, the slogan should be RAISE AN EXTRA PIG PER LITTER. With the shortage of labor on farms, this is not an easy task.

Average figures for the United States show that out of every 100 pigs farrowed only 56 are raised to market age. Of the 44 lost, 27 die the first 10 days after birth. This figure very largely includes those pigs that are born dead or weak, are chilled, mashed or crippled. We should analyze these losses, determine the cause and provide a remedy.

Sows that have plenty of exercise, a well balanced feed mixture and comfortable, roomy, well bedded and well ventilated sleeping quarters usually farrow a high percentage of live pigs. Fighting sows should be taken out of the herd and kept alone. The nesting arrangement should be ample and easily accessible.

If the feed is too bulky the latter part of the gestation period, the feed with hull or fiber may be reduced somewhat and replaced with 5% of bran to make sure that the digestive tract functions properly.

The principal hog growing section of the United States lies in an area where there is apt to be a shortage of iodine in the feed and water. It is a variable factor. A slight deficiency of iodine in the brood sow may often be indicated by weak pigs at birth while an extreme shortage will produce goiter or hairless pigs. The latter rarely ever live and most often are dead at birth. Fortunate is the breeder who has supplied potassium iodide to his sows during the winter months. It should be fed for a minimum of 60 to 70 days prior to farrowing, but a few borderline cases may be helped within a shorter period.

In some unnatural cases, a sow after farrowing has an unusual craving for flesh and animal protein and will devour one or more of her pigs at birth. Some of these cases can be avoided by using a higher percentage of animal protein in the feed a week or more before farrowing. In some cases, high fever or labor pain may be the cause. Sometimes it is an inherent mean disposition, and in this case the sow should be des-

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tined for market. In most cases it is well to keep the pigs away from the sow's head at farrowing time, especially when she has a labor pain. In cases where the sow has a tendency to devour pigs, take a rag and dampen slightly with kerosene and rub lightly over the hair of the new born pig. This sometimes solves the problem. If this fails, it may be necessary to feed the pigs on a bottle and place them on other sows farrowing within a day or two.

In order to reduce loss by the sow from "overlaying" or crushing the pigs and to save labor, the pig brooder should be installed, preferably on an inside corner of the pen next to the alley. This will induce the pigs to stay away from the sow a good share of the time. The brooder should be used for about 10 days, the first 5 to 7 days are most important. If they are removed early, they should be replaced with corner boards fastened parallel to and about 10 inches above the floor with an upright board in front to keep in the bedding. Pigs are very fond of this retreat because of the warmth that it provides. The brooder and corner board may be considered as equipment that helps the pig save himself. Arrangements should be provided for this equipment in advance of farrowing.

If the floor of the farrowing pen is concrete, clean it out and scald it thoroughly with boiling hot lye water several days in advance of farrowing. Wash the sow if the weather is favorable, otherwise, wash only the sides and udder in order to remove bacteria and filth. If the pen has a dirt floor, the upper 3 inches of soil should be removed and replaced with soil from a field that has not been overrun by hogs for several years.

It is important that some heat be provided in the hoghouse for early farrowing, but the temperature need not be more than 60 to 65 degrees at the floor. Preventing drafts is equally important. If the barn has electric wiring, a fan may be placed near the stove to circulate the air and provide a more uniform temperature. Some breeders recommend covering a stove with stone or brick in order to radiate heat during the night when no one is in attendance.

A good herdsman makes a practice of giving extra attention to a brood sow several days in advance of farrowing. She should be brushed occasionally and acquainted with her new pen. Short straw for bedding should be provided in preference to long straw. These apparently minor considerations pay good dividends.

When the first pig arrives it should be thoroughly dried if it is breathing properly. Then the

navel cord should be broken and the raw end dipped into an iodine solution. This is also the time to clip the needle teeth close to gums and weigh the pig. Since there is a strong correlation between size of pigs at birth and early maturity, this is important. It is also valuable information for sows that qualify for Registry of Merit. When these operations are performed, it is best that they are done where the sow cannot hear the pig squeal, preferably in a separate room if possible.

Mistakes are often made in feeding sows both before and after farrowing. When the sow shows signs of farrowing within 12 to 24 hours, reduce the quantity of feed somewhat. After she has farrowed she usually does not care to eat for some time, but she should have lukewarm water available at all times.

As a rule, the first feed after farrowing should not be more than a double handful of ground feed in a thin slop of warm water or milk. If the sow has a ravenous appetite, give her a handful of forage to nibble at and hold her back on the feed as much as possible. Increase the feed slightly each day in order to induce the milk flow gradually. This will not only avoid udder trouble, but will also prevent scours in the pig. Normally a sow should not have more than one-half pound of feed for each of the two feeds the day after farrowing. This can be increased one half pound each feed or one pound daily until she receives about 4 pounds daily the 5th, 6th and 7th days. This quantity will naturally vary somewhat in individual cases.

The amount to increase after the first week depends on the size of the litter and condition of the pigs. It is not considered a good policy to have the pigs fat while small. If a sow appears to be milking too heavily and still it seems inadvisable to cut the quantity of feed, it may be necessary to reduce the protein content of the feed for some time. As the pigs approach weaning age, a sow with a big litter may require 12 or more pounds of feed a day in addition to hay or pasture. After farrowing, bulky feeds should be used more liberally.

Some breeders are inclined to look with disfavor on the sow that goes down in flesh while nursing pigs. The experienced breeder knows that these are his best sows as a rule because a good milking sow will take fat off her body to produce milk in spite of liberal feeding. These same sows will gain rapidly after weaning the pigs.

Exercise is important for both sow and pigs. They may use the outside lot if it is clean and the weather permits. Pigs may also use the alley of the hog barn. Sacks nailed to posts and news-

papers scattered in the alleyway induce the pigs to exercise.

Too often water is not made available to nursing pigs. They begin to drink at an early age and should have access to plenty of clean water in order to grow rapidly.

From the time the pig is born until he starts to eat feed and usually for some time afterward, he may be subject to anemia if kept inside on concrete or wooden floors. In this ailment the hemoglobin (red corpuscle) content of the blood decreases unless he has access to dirt lots. For early farrowing, soil should be placed in the pen when the pigs are 2 weeks old. This soil should be very fine and from a field that has not been overrrun by hogs for several years. This will not always avoid the trouble.

Like other ailments, it is best to avoid the ailment rather than to cure it. A helpful remedy quite widely used is as follows: Mix 50 pounds calcium carbonate (lime) with 1 pound of iron sulphate and ¼ pound of copper sulphate. Place a small amount on the floor for the pigs and sprinkle a small quantity into the bedding each day. If both of these precautions fail to check the trouble, it may be necessary to dose some pigs individually.

One popular remedy used either as prevention or cure of anemia is made up as follows: Into 5 quarts of water, mix 3½ ounces of iron sulphate and 6 drams of copper sulphate. The daily dose for an affected pig is one teaspoonful of this solution. It is most easily given with an eye dropper on the back of the tongue, holding the head of the pig on the level to prevent the solution from entering the lung cavity. Since this solution is very distasteful, there is no harm in adding some molasses or syrup to make it more palatable.

A pig fed an iron solution constantly, will begin to show a frowziness in the coat of hair and appear to be unthrifty. Nutrition specialists believe that the iron solution has a tendency to destroy some of the vitamins in the feed of the pig. Therefore, the treatment should not be continued too long. Where anemia is prevalent every year, some hog breeders give one dose of the iron solution a week to each pig for 2 to 4 weeks as a preventative measure after the pigs are 2 weeks old. This has given good results.

When a pig shows symptoms of anemia, he often is so far gone that the remedy is not effective. Most pigs become anemic after 3 weeks of age, but some pigs are ailing at birth. When affected they are pale around the ears, nose and eyelids, have little appetite, are weak and inactive. It cannot be corrected in the feeding of the sow because the best ra-

tions fail to give any iron to the pig through the sow's milk.

The treatment commonly known as swabbing the udder of the sow with an iron solution has lost some of its popularity. Iron sulphate has a shrinking effect on tissues and when a strong solution is applied directly to the nipple of the udder, it has caused some sows to dry up. When used, this precaution should be observed. Swab the fleshy portion of the udder and not the nipple. Applying iron sulphate in syrup or molasses to the udder has not met with favor, because straw, chaff and dirt may stick to the udder unless applied while the pigs are nursing.

New Knowledge of Ruminant Digestion

Condensed from American Miller and Processor

C. W. Turner

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An old story is that ruminant animals have four stomachs instead of one, that they are able to eat coarse roughage and that they regurgitate and "chew their cuds." However, recent study of the anatomy and physiology of the ruminant apparatus and the changes, both good and destructive, which take place before the food reaches the stomach indicate that our knowledge of the nutrition and feeding of ruminant animals is just in its infancy. Within the next few years many changes are predicted in standard feeding practice based upon the development of new knowledge of ruminant nutrition.

Instead of considering that ruminant animals (goats, sheep and cattle) have four stomachs, it is better to consider that in these animals a huge fermentation and digester tank has been developed in front of the true stomach as an enlargement of the esophagus. In this tank the process of breaking down the food preliminary to digestion takes place. Instead of digestive juices a host of organisms begin an attack on the food. Bacteria of many kinds are present. Yeast cells grow in profusion and many one-celled animals or protozoa multiply in this huge vat. Their job has been thought to be primarily one of breaking down the starches, cellulose and other car-

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bohydrates (lignin, etc.) present in the crude roughages consumed. I do not desire to discount the importance of this process in ruminants. It is essential in the utilization of roughage. However, it is only one of a number of processes going on in the digester tank which make unique the nutrional problems of the ruminant.

When cows are grazing on pasture or eating hay in the barn, the food is compacted into balls or boli in the mouth and swallowed. These food balls pass into the rumen or fermentation tank and are agitated by the movement of the muscular walls. Water and huge amounts of salivary secretions are mixed with the food but since the saliva contains little if any digestive juices, the softening of the roughage is accomplished by the rumen organisms. As bacteria, yeast and protoza grow and multiply these organisms secrete digestive enzymes which permit them to absorb food on the surfaces of their bodies or in their simple digestive tracts.

These enzymes act upon pieces of roughage, softening and eventually liquifying the nutrients between the more fibrous parts of the plant. The warmth of the body keeps the temperature of the mixture suitable for the rapid multiplication of these organisms. The churning motion of the rumen aids in the softening process. In the course of 1 to 14 hours of this action in the cow, the crude fiber in the roughage is partially broken down. The more soluble part passes to the stomach whereas the coarser material is regurgitated or brought back to the mouth for a final chewing and then sent back to the rumen in preparation for transmission to the true stomach.

Let us now consider some of the other processes, both good and bad, going on in this glorified fermentation tank of ruminant animals. From the fact that yeasts abound in the tank with lots of food available, one might expect development of yeast protein comparable to the production of yeast in the vats of yeast companies. It is also known that yeast synthesizes many vitamins of the B-complex. Similarly, many types of bacteria synthesize these same vitamins. Thus it is not surprising to find that riboflavin is increased 80 to 100 times in the rumen. It has been shown that this riboflavin is available for later absorption in the digestive tract, for it has been observed that lactating cows may secrete 10 times as much riboflavin in their milk as is present in the food consumed.

Another vitamin of the B-complex, nicotinic acid appears to be increased 3 to 4 times during its stays in the rumen. Thiamin or B_1 is also produced in considerable amounts as are also panto-

thenic acid, pyridoxine, and biotin. The mature ruminant animal is thus not dependent upon the vitamins of the B-complex in the ration. The calf or other young ruminant, however, may require extra vitamin B's until the rumen develops.

As is well known, vitamin C is present in large amounts in green foliage. It has surprised dairymen to find little or no improvement in the vitamin C content of the milk when cows were placed on pasture grass in the spring. It has been discovered that again the rumen is involved. Not only is no vitamin C synthesized in the rumen but it has been shown that ascorbic acid either in the green roughage or added as crystalline ascorbic acid is quickly destroyed. The vitamin required by the animal and that transferred to the milk must be produced from some other source as yet unknown.

The fat soluble vitamins are apparently little influenced favorably or unfavorably by the changes in the rumen. Vitamins A and D are required by ruminants but their requirements are comparable with those of other species so that it appears neither synthesis nor excessive loss occurs. Vitamin E is not required by goats. No evidence is available that E is produced by the rumen. It has been shown, however, that vitamin K was abundant in the rumen contents of a cow, fed on a ration almost devoid of vitamin K.

Therefore the ruminant animals differ from most non-ruminant animals, in being able to synthesize their requirements of the vitamin B - complex through the abundant growth of bacteria and yeast in their fermentation tanks carried with them. Vitamin C, however, is not so fortunate as destruction of this food factor is almost complete.

The most revolutionary new development in the study of ruminant nutrition is the discovery of the ability of their fermentation tanks to actually synthesize high priced protein from cheap non-protein-nitrogen. In fact considerable evidence is available to indicate that little of the digestible protein fed to ruminants actually reaches the true stomach of these animals. Instead, the protein fed is consumed by the bacteria, yeast and protozoa to promote their growth. The ruminant animals then secure their protein requirements by digesting the bacterial, yeast and protozoan cells.

The implications of these new concepts of ruminant nutrition will have far reaching effects upon feeding practices in goats, sheep and cattle in the near future. First let us consider the ability of the rumen to synthesize protein. Extensive trials have now been reported both with

sheep and cattle, proving that considerable amounts of urea, a simple nitrogen compound, $CO(NH_2)_2$, when fed is converted by the rumen organisms into protein. Study of the rumen content shows that the urea gradually disappears and in its place there is an increase of protein. Ammonium bicarbonate ($NH_4 HCO_3$) is another good source of nitrogen which the rumen "bugs" can utilize.

Heifers continue to grow when a ration low in protein has had urea added to the ration. Urea nitrogen when ingested as 1 to 5% of the dry matter of the ration disappeared from the rumen in 4 to 6 hours after feeding. In some experiments the protein content of the rumen contents increased over 50%.

Naturally, for the growth of rumen organism, a source of energy for growth must be provided. Starch or molasses and the urea apparently provide a nutrient medium suitable for the growth of these "bugs." In the absence of either energy in available form or nitrogen, growth of the organism will be slow and the production of new protein will be limited. On the other hand, if a high protein ration is provided, the rate of conversion of urea nitrogen to protein is decreased. This may be due to the preference of the rumen organisms for preformed protein when it is available. When sufficient protein is absent, the bacteria and yeast then build up body protein from nitrogen.

In recent news releases, the possibility of producing huge amounts of dry yeast having a desirable meat-like flavor and of high protein content in tanks of reasonable size has been described. While this system may some day by-pass live stock production and a yeast steak may substitute for porterhouse steak, it is interesting to find that sheep and cattle have been making use of this very system for ages and those good steaks are in fact transformed from yeast and bacteria protein.

The use of urea as part of the ration of growing sheep and cattle pointed the way for trials with milking cows. Recently, it was demonstrated that urea could substitute for linseed meal for milk production. In trials at the Wisconsin Station, 15 cows completed lactation tests on a basal ration containing 10% protein. For comparison these same cows completed lactations on diets with added urea or linseed meal bringing the basal ration to 18% protein equivalent. During the lactations on the basal ration, the average milk production was 7855 lb. of 4% milk. When urea was added milk production increased to 8988 lb. of milk and on linseed meal to 9355 lb. of milk. These latter differences were not con-

sidered significant. The composition of the milk and the flavor of the milk were not different on the two rations.

The recommendations of the Wisconsin investigators concerning urea feeding follow: Urea (46% nitrogen) should not be fed at a rate greater than about 1% of the dry matter of the ration or 3% of the concentrate mixture. In sections where hay, silage, and homegrown grains are available, a suitable nitrogen level in the concentrate mixture can be secured by the addition of 3 lb. of urea to 97 lb. of the grain mixture.

A great deal of study has been devoted to the quality or biological value of proteins. Some proteins are deficient in certain amino acids and are regarded as of inferior value for growth or other productive processes. In others, the essential amino acids are present in suitable amounts resulting in proteins of superior nutritional value. Most of the study of the proteins to determine their value for growth or for milk production have been conducted with laboratory animals with simple digestive systems. Considerable differences in the value of the common feed proteins have been observed. On the basis of this work it has been presumed that certain protein feeds of high biological value to non-ruminants would also be of superior nutritive value for growth and milk production of cattle. The feeding of a variety of high protein feeds, some of considerably greater cost than others, has been practiced with the hope that the inferior proteins would be supplemented by the superior proteins.

That the feeding of quality protein to ruminants under present conditions is of little or no value now seems to be well established. On the basis of experiment in which proteins of varying biological value (as determined on laboratory animals) have been tested in ruminants little or no difference can be detected. As a matter of fact, as stated earlier, it is the opinion of nutrition authorities that most of the digestible protein fed to ruminants is converted in their fermentation tanks into proteins characteristic of the organisms or "bugs" growing there. This organismal protein (bodies of the bacteria, yeast and protozoa) has its own characteristic biological value whether it is formed from high quality protein or even built up from urea or other nitrogenous compounds.

As this new knowledge of ruminant nutrition becomes more widely appreciated, there should be a tendency toward more simple mixed feeds, utilizing the single high protein sources cheapest in that region. After the war when chemical plants now manufacturing explosives are released for peace-time use, there should be a

great increase in the feeding of urea and other nitrogen-containing compounds.

With the development of these new concepts, it is quite possible that future research may show how other advantages may be taken of our understanding of the processes going on in the rumen. Possibly, clever research men will be successful in establishing types of bacteria, yeast, etc., capable of developing protein of higher biological value for lactating dairy cows than the present strains. Thus by adding these cultures to the grain mixture they would be able to quickly multiply and compete successfully with those present in the roughage.

The type of organism and their growth rate may be influenced also by the chemical conditions present in the rumen. It is possible that acid silages may be used to advantage. The presence in the ration of molasses or other quickly available sugar for use by the organisms in the rumen should be explored. The science and art of the fermentation industries may contribute much to the newer knowledge of ruminant nutrition.

I said earlier that the feeding of quality protein to ruminants was of little value. It is not impossible, of course, that a way may be discovered by which quality protein could be fed in a protected condition. By protected condition I refer to the protection of the protein from the rumen organisms so that they could pass subtantially intact into the true stomach for digestion and absorption in the digestive tract. How the protein could be protected is not known. Possibly a coating of some type on smaller or larger particles would do the job. Such a coating would have to protect the protein from water and a slightly alkaline condition during a period of hours in the rumen and then dissolve or disintegrate in the acid condition of the true stomach or in contact with the digestive juices of the small intestine.

In a previous article in the AMERICAN MILLER, the writer described the preparation at the Missouri Station of an iodinated casein called protamone possessing high thyroidal activity. When this material was fed to dairy cattle as part of the ration, milk and fat production was increased during the normal declining part of the lactation period. It has been recognized for a number of years that the dose of the thyroid hormone required to influence milk production of cows when injected under the skin was very small and when fed was relatively large. Further, during the past year or two, it has been discovered that the difference in the relation between the oral and subcutaneous administration of this substance

in non-ruminant animals and poultry was rather small. This pointed to the rumen as the probable source of losses of protamone rather than the stomach or intestines. Work is now in progress to definitely establish the location of the losses but from the work already mentioned it is suspected that the rumen organisms will be found to be the "villains" in the case. We have found by careful assay that only 2½ to 5% of the thyroid hormone escapes destruction in comparison with subcutaneous administration.

While the potency of our thyroid preparation is high, the cost of oral administration in amounts required to stimulate milk production could be greatly reduced if a method could be found to protect the iodinated casein protein from the rumen organisms. A number of coating materials have been tested but so far without success. Many new organic compounds are being synthesized. If such compounds appear to possess properties that might make them suitable as coating or protecting agents, the writer would be happy to learn of them so that their properties may be put to an actual rumen test.

Some preliminary work has also been conducted with a second hormone, the synthetic estrogenic compound called stilbestrol. This compound when injected into goats and cattle in suitable amounts stimulates the growth of considerable udder tissue and the secretion of milk. Without being with-calf, heifers and sterile cows have been induced to secrete considerable amounts of milk. This hormone has been observed to be quite effective orally in the human and in small experimental animals but in the dairy goat our tests show that about 100 times the injected dose is required when given orally. The finger of blame is again pointed at the rumen organisms. The use of hormone preparations in a practical way would be greatly increased if oral administration were feasible. Protection of the hormone during its stay in the rumen may be one answer to this problem.

In addition to the examples cited, there are undoubtedly many other conditions where protection of compounds during their stay in the rumen would be beneficial.

Management of Dry Cow, Calf and Heifer

Condensed from Guernsey Breeders' Journal

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THE items of cost incident to milk production are usually indicated under the headings of feed, labor, buildings, cattle, bedding, sire, and miscellaneous expenses such as veterinarian fees, fuel, refrigeration, and hauling. It takes a specific amount of feed nutrients to maintain the dairy cow and an additional quantity for any given amount of milk of known quality that she produces. If the cow does not get those necessary feed nutrients, she either does not produce a specific amount of milk or she loses weight, or both. In the same way, labor to perform the essential operations in feeding, milking and caring for the cow are a rather definite item of expense in operating a dairy herd.

Seldom is herd management considered an important item in obtaining profitable results with a herd of dairy cattle. Yet it is a matter of common observation that individual dairy farmers under almost identical conditions of soil and markets are getting widely different results with their herds. Some individuals are good managers and others are poor managers. The successful manager usually has his business so organized and planned that the operations are conducted in the right way and at the right time.

Sexually, sheep are the most healthy of any of our domestic animals, while dairy cattle are subject to the most disease of reproduction. Since the whole dairy industry is based on milk production by the individual cow, and this function is a by-product of producing the calf, this matter of obtaining effective reproduction with the dairy herd is of great economic importance.

Dairy cows have been spayed in an effort to eliminate the frequent reproductive cycles. These experiments have failed to get the desired results because nature requires a period of rest from lactation at regular intervals, evidently to restore the body reserves of minerals, especially calcium and phosphorous removed during a lactation period, and to condition the udder for active milk secretion. Sheep have a breeding season which usually extends over a very limited period of a few months in the fall. The

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lambs are born in the spring, nursed by their mothers for a few months, and then are sold or weaned. The ewes have a period of rest both from lactation and gestation before starting a new cycle. The profitable dairy cow is in lactation or gestation or both from the time she is bred as a heifer for the first calf until the end of her career. Careless planning and management of these reproductive cycles in the dairy cow are responsible for the great losses experienced through the effects of diseases of reproduction in many dairy herds.

It is natural for cows to calve once each year. It has been found that a breeding program planned to give the cow a period of ten months in lactation, two months dry period, and a calving period within the year results in a larger and more profitable milk production than when delayed breeding is practiced. Cows bred at the heat nearest to ninety days following previous calving will freshen about the same time each year. This ninety day period of rest from gestation seems to be the most practical from the standpoint of giving nature a chance to overcome any infections of the reproductive tract incurred during the previous gestation or calving period in order to provide for an effective conception and successful gestation period.

A Clemson study on the relation between the interval elapsing after calving and the first services required for conception shows that when cows were bred the first time within 63 days of calving the conception rate was only 42.4 per cent, while this rate of conception was increased to 61.7 per cent between 63 days and 83 days. All the intervals between 83 days and 167 days showed higher conception rates than for this first 63 day period. It, therefore, seems that the dairy cow should have a definite rest period from gestation in the early part of her lactation period, and she needs a definite rest period from lactation at the latter part of her gestation period. To provide this balance requires careful management of the breeding program and scheduling of the dry periods.

The three general methods usually practiced for drying off cows are incomplete milkings, intermittent milkings, and the complete cessation of milkings. If a cow has a sound udder, the sudden and definite stopping of the milking program is the best plan. When milking is stopped milk continues to accumulate in the udder and will build up a back pressure against the secreting cells stopping further milk production. This pressure will be reduced gradually after the milk secretion is stopped and the milk accumulated in the udder will be resorbed. The udder will become

soft and pliable within a few days. This plan permits the cow to start her rest period almost immediately from the date on which she is started to dry up and does not require any changes in the feeding program. The udder should be watched and if any indication of fever develops the cow should be milked out clean and the program started over again. The next best plan is the intermittent method. Under this plan the cow is milked once a day, then once in two days and so on until she is giving so little milk that it is not necessary to continue. Every time the cow is milked under this plan all the milk in the udder is removed. The plan of drying off the cow by incomplete milking consists of removing just enough milk from the udder at each milking to relieve the pressure in the udder. This method is not recommended and should be discontinued in favor of one of the other methods described. The failure to get the cow dry promptly is often responsible for reducing by ten days or two weeks the rest period.

The dry cow is often neglected because she is not providing any income. Too often in the summer inadequate pastures furnish the only feed for these cows, and in the winter refused feed from the milking herd is often the main source of their feed supply. These dry cows need feeds rich in vitamins, minerals and energy. The limited amount of proteins needed are usually furnished with nutritious pasture or leafy green hays, or preferably both. The principal requirement for feed nutrients during this dry period is to condition the cow for her next lactation period rather than to nourish the unborn calf. A calf weighing 70 pounds at birth contains only about 17 pounds of dry matter. The analysis of this dry matter is shown to be almost identical to that of the dry matter in milk. Since a cow will produce this amount of dry matter in her milk within three or four days after calving, it is evident that carrying the calf is no serious drain on the feed supply of the dairy cow. In fact, this requirement is so small and is distributed over such a long period that none of the feeding standards take into consideration this requirement.

In recent years many herds have experienced attacks of Acetonemia with many of their cows soon after calving. These cases result in great loss of milk production, and in some cases the death of the cow. This metabolic disorder is associated with inadequate and improper feeding during the dry periods. The feeding of liberal quantities of high quality legume hay with little or no silage as roughage during the dry period has proved quite effective

in preventing this disease. It is generally agreed that for best results the dry cow should be fed so as to be gaining in weight up to the calving time. This gain in weight not only provides reserve nutrients required for milk production following calving but also promotes the prompt shedding of the afterbirth. These requirements indicate the wisdom of feeding some concentrates, three to eight pounds per day depending upon the condition of the cow, in addition to good pasture and legume hay, especially during the latter half of the dry period.

Since the shedding of the afterbirth has such an important bearing on the welfare of the cow and her production of milk following calving, it is important to observe certain rules in managing the cow at calving time. The cow will usually drink large amounts of water immediately after calving. If this water is cold it brings about congestions which often result in retained afterbirth. It is wise, therefore, to take away the drinking cups, or otherwise protect the cow from drinking very cold water at this time. Provide the cow with warm water at body temperature, or a little higher, until the afterbirth has been shed.

Very few cows require milking before calving. Cows with extremely large udders and some of the heaviest producers possibly may be helped through the calving period by starting to milk a week before calving. When this is practiced, it is necessary to have on hand colostrum milk from other cows for the calf, or else it will be very difficult to save. The University of Nebraska has developed a plan whereby surplus colostrum is frozen in advance for use with calves whose mothers are milked before calving. This milking before calving in many instances has reduced greatly the incidence of milk fever and has proved effective for protecting the udder from injury at calving time. In general it is not practical to milk the cow before calving nor to remove more milk than the calf requires from the udder up until 36 hours after calving. The rapid secretion of milk following calving draws large quantities of calcium from the blood and is the immediate cause of milk fever. Leaving the milk in the udder produces back pressure which slows down milk secretion in such a way as to give the regulatory mechanism of the body an opportunity to adjust the calcium content of the blood to this new greater requirement for this element. Leaving the milk in the udder does about the same thing that was accomplished with the older air inflation treatment for milk fever.

An essential for insuring the birth of a normal calf is to provide the mother with suitable

quarters at calving time. During the mild summer weather this condition is often furnished by having several small grassy lots in which individual cows may be placed for calving. During most of the year, however, suitable box stalls are desirable. The box stall, preferably with a concrete floor that can be thoroughly washed out and disinfected between each calving is necessary. Clean bedding for this clean stall is essential. It is wise for an attendant to observe each cow through the calving period in order to know whether she needs assistance and to prevent suffocation of the calf at birth.

Soon after the calf is born, the naval cord should be painted with tincture of iodine to prevent infection. The calf should be watched to see that it nurses the colostral milk from its mother. The usual practice is to leave the calf in the box stall with its mother three days in order to assure that it gets the colostrum. Before the calf is removed from its mother it should be permanently identified by tattooing a herd number in the ear. A system of herd numbers beginning with the oldest animal and carried through continuously is important to maintain accurate herd records. If either white scours or calfhood pneumonia is prevalent in the herd, the calf should be given the proper prophylactic treatments.

Pneumonia is the cause of death of many young calves. The removal of the calf to pens that have false floors made of either wire netting, steel grating, or wood construction has proved effective in preventing not only calfhood pneumonia but many other diseases frequently encountered at this period. These raised platforms keep the calf warm and dry, require very little bedding and reduce the labor required.

Under conditions that exist on many farms, especially in the large herds, colostrum mixed with reconstructed skim-milk powder or fresh skim-milk to the normal consistency of whole milk will replace all of the whole milk normally used in calf feeding. This is especially important during these war times. In the Clemson herd of 200 milking cows no whole milk is used for calf raising except possibly now and then when no fresh cow is available to furnish the colostrum milk required. Colostrum has been considered unsuitable for calf feeding because it often caused scours when fed without diluting with skim-milk. No rate of mixing the skim-milk with colostrum can be given because colostrum changes in consistency from day to day with individual cows. A little experience will soon indicate the proper proportion of skim-milk to colostrum for best results.

Feeding of calves with nipple

pails for the first six weeks to two months has proved effective in preventing certain types of digestive disturbances. Better results are obtained because with a nipple the calf is required to take only small swallows which pass directly to the fourth compartment of the stomach. With the large gulps that result when the calf is fed milk from an open pail, much of the milk passes into the rumen or first compartment where it goes through putrefaction and fermentation causing digestive disturbances.

It is well to leave young calves in their pens with the false floors for their first month or six weeks. In good weather they should then be turned to small, well-drained lots containing shade, hay rack, clean pure drinking water, and a salt box. The hay rack in the calf lot will almost completely prevent sucking. The older calves teach the younger calves to eat hay and their hunger becomes satisfied.

The heifers past a year of age are usually the most neglected of all classes of dairy cattle. Most investigations indicate that it is not wise to feed dairy heifers at any time on concentrates sufficient to cause any substantial fattening. However, it is desirable to get dairy heifers bred and into milk production at reasonably early ages in order to save on cost of growing them. It has been observed that dividing the heifers into three groups, if the herd is large enough to justify it, is quite effective in producing normal growth with the least cost. Heifers between the time they are weaned from milk or milk substitutes to breeding age form one group. The group from breeding age to the time the heifers begin to show that they are safe with calf form a second group, while the third group consists of those that are definitely shown to be with calf. It is possible to grow heifers fast by heavy feeding, or slowly by more restricted feeding so that age is not the best measure for determining the time to breed. Weight instead of age is considered the best indication for determining a breeding schedule. Guernsey heifers should weigh approximately 600 pounds or measure 59 inches in heart girth when they are bred for the first time.

The springing heifer should be fed liberally in the same way as indicated for the dry cow with possibly more emphasis given to having them in good flesh at calving time. After calving, the heifer has not only the heavy nutrient requirement of milk production but also for growth.

Many of the necessary operations for the successful management of dairy herds require timing for profitable results.

FOR THE FARMER'S LIBRARY

These books are recommended as outstanding in their field:

A Living from Bees—By Frank C. Pellett, Field Editor of American Bee Journal. Orange Judd Publishing Co., Inc. (1943). $2.00.

America's Garden Book — By Louise Bush-Brown and James Bush-Brown. Charles Scribner's Sons (1939). $3.50.

Animal Sanitation and Disease Control—By Dr. R. R. Dykstra, Dean of the School of Veterinary Medicine, Kansas State College. The Interstate Printers and Publishers. $2.85.

Beekeeping — By Everett Franklin Phillips, Professor of Apiculture, Cornell University. The Macmillan Co. $4.00.

Beef Cattle — By Roscoe R. Snapp, Asso. Prof. Animal Husbandry, Univ. of Illinois. John Wiley & Sons, Inc. $4.00.

Beef Cattle Production in the South—By D. W. Williams, Head, Department of Animal Husbandry, A. & M. College of Texas, College Station, Texas. The Interstate Printers & Publishers (1941). $2.00.

Dairy Cattle and Milk Production — By Clarence H. Eckles, B.S.A., D.Sc., late Chief, Div. of Dairy Husbandry, Univ. of Minnesota. The Macmillan Co. $3.90.

Dairy Science — By W. E. Petersen, Ph.D., Assoc. Prof. and Assoc. Dairy Husbandryman, Univ. of Minn. Edited by R. W. Gregory. J. B. Lippincott Company (1939). $4.00.

Farm Shop Practice—By Mack M. Jones, M.S., Agri. Engineering, Univ. of Mo. McGraw-Hill Book Co., Inc. $2.75.

Feeds and Feeding—By F. B. Morrison, Prof. of Animal Husbandry and Animal Nutrition, Cornell Univ. Morrison Press. $5.00.

Farm Meats—By M. D. Helser, B.S.A., M.S., Prof. Animal Husbandry, Iowa State College. The Macmillan Co. $3.25.

Farm Management—By Robert R. Hudelson. The Macmillan Co. $2.00.

Farm Management and Marketing—By V. B. Hart, Ext. Professor of Farm Management; M. C. Bond, Ext. Professor of Marketing; L. C. Cunningham, Ext. Asso. Professor of Farm Management; all of N. Y. State College of Agriculture, Cornell University. Publishers: John Wiley & Sons, Inc. (1942). $2.75.

Farm Accounting—By Donald R. Mitchell, Asst. Prof. Agri. Economics, Univ. of Wisc. McGraw-Hill Book Co., Inc. (1941). $2.50.

Forestry in Farm Management—By R. H. Westveld and Ralph H. Peck. John Wiley & Sons, Inc. (1941). $3.00.

Gardening for Good Eating—By Helen Morganthau Fox, Gardener and Author. The Macmillan Co. $2.50.

Grow Your Own Fruit—By M. G. Kains, formerly with U. S. Dept. of Agriculture; Professor of Horticulture, Pennsylvania State College. Charles Scribner's Sons. $3.50.

Home Vegetable Gardening—By Charles S. Nissley, Extension Horticulturist in Vegetable Growing. Rutgers Univ. Press (1942). $1.50.

How to Raise Rabbits for Food and War—By Frank G. Ashbrook, Fish and Wildlife Service, U. S. Dept. of the Interior. Orange Judd Publishing Co., Inc. (1943). $2.00.

Livestock Production—By Walter H. Peters, Chief of the Division of Animal and Poultry Husbandry, Univ. of Minn. McGraw-Hill Book Co., Inc. $3.50.

Plowman's Folly — By Edward H. Faulkner. University of Oklahoma Press (1943). $2.00.

Poultry—By A. R. Winter, Asst. Prof. Poultry Husbandry, Ohio State Univ., and E. M. Funk, Asst. Prof. Poultry Husbandry, Mo. State Univ. J. B. Lippincott Co. $5.00.

Pork Production—By William W. Smith, Prof. of Animal Husbandry, Purdue Univ. The Macmillan Co. $3.75.

Practical Poultry Management—By James E. Rice, Emeritus Professor of Poultry Husbandry, and Harold E. Botsford, Extension Professor of Poultry Husbandry, both at New York State College of Agriculture. Fourth Edition (1940), John Wiley & Sons, Inc. $2.75.

Practical Horse Breeding and Training — By Jack Widmer. Charles Scribner's Sons (1942). $3.00.

Repairing Farm Machinery—By Ivan G. Morrison, Asst. Professor Agri. Education, Purdue University. The Interstate Printers & Publishers. $1.80.

Sheep Production—By Levi Jackson Horlacher, B.S.A., M.A., Asst. to Dean, Col. Ag. Univ. Ky. McGraw-Hill Book Co., Inc. $4.00.

Sheep—By Levi Jackson Horlacher, Prof. of Animal Husbandry, Univ. of Kentucky. The Interstate Printers and Publishers. $2.00.

Soil Conservation — By Hugh Hammond Bennett, Chief, Soil Conservation Service, U. S. Department of Agriculture. McGraw-Hill Book Company, Inc. $6.00.

Some Common Diseases of the Horse—By George R. Conn, B.S.A.H., D.V.M., Orange Judd Publishing Co., Inc. (1942). $1.50.

Some Common Diseases of Cattle—By George R. Conn, B.S.A.H., D.V.M. Orange Judd Publishing Co., Inc. (1942). $1.50.

Soybeans—Gold from the Soil — By Edward Jerome Dies. The Macmillan Co. $1.75.

The Home Veterinarian's Handbook—By E. T. Baker, Veterinarian, Moscow, Idaho. The Macmillan Company (1943). $2.50.

The Farm Primer—By Walter Magnes Teller, formerly with the Farm Security Administration, U. S. D. A. David McKay Co. $2.50.

The Western Horse—Its Training, Type and Marketing. By John A. Gorman, Asso. Prof. Animal Production, Univ. of Wyoming. The Interstate Printers and Publishers. $1.65.

BOOK NOTES

An Agricultural Testament, by Sir Albert Howard, C. I. E., M. A., Former Director, Institute of Plant Industry, Indore, and Agricultural Adviser for Central India and Rajputana.

This is a significant book for gardeners and farmers who are interested in the use of organic fertilizers. Sir Albert Howard has forty years of active experience in the field of organic fertilizers and is an accepted leading authority on the subject.

Publishers: Oxford University Press 253 pages $3.50

Profitable Poultry Keeping, by H. Clyde Knandel, Prof. and Head, Department of Poultry Husbandry, Pennsylvania State College.

Here is a thorough, fundamentally sound, and practical text covering all phases of poultry keeping, including breeds, rearing, feeding, housing, breeding, judging, diseases and marketing. It is the type of book that will be helpful to students, farm flock owners and commercial poultry raisers.

Publishers: Orange Judd Publishing Co., Inc. 462 pages $3.00

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